Nature Magazine

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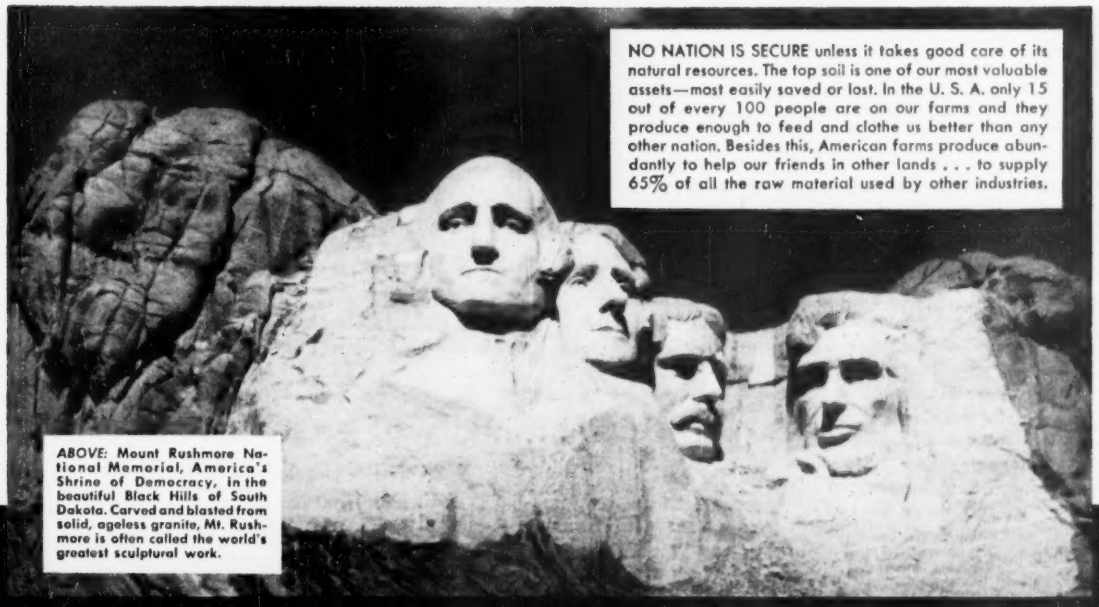
These four Farmer-Statesmen found the "Roots of Freedom" in the soil!



NO NATION IS SECURE unless it takes good care of its natural resources. The top soil is one of our most valuable assets—most easily saved or lost. In the U. S. A. only 15 out of every 100 people are on our farms and they produce enough to feed and clothe us better than any other nation. Besides this, American farms produce abundantly to help our friends in other lands . . . to supply 65% of all the raw material used by other industries.

ABOVE: Mount Rushmore National Memorial, America's Shrine of Democracy, in the beautiful Black Hills of South Dakota. Carved and blasted from solid, ageless granite, Mt. Rushmore is often called the world's greatest sculptural work.

"I know of no pursuit in which more real and important service can be rendered to any country than by improving its agriculture . . ."

—GEORGE WASHINGTON

"The Farmer: The Cornerstone of Civilization."

—THEODORE ROOSEVELT

"Let the farmer forevermore be honored in his calling—for they who labor in the earth are the chosen people of God."

THOMAS JEFFERSON—

". . . no other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought, as agriculture."

—ABRAHAM LINCOLN

You can help preserve that freedom through sound soil conservation

Your freedom . . . America's freedom . . . is rooted in the topsoil!

Washington knew this when he spoke out for soil conservation. Jefferson, Roosevelt and Lincoln knew it when they spoke for agriculture. Because they were farmers themselves, all four knew that hunger and poverty breed war and strife . . . that food and the products of the farm are powerful weapons for peace and freedom. They knew, too, that America's agriculture and the enterprising American farmer were, and are, keys to American greatness . . . that the industry of the soil was, after all, the basic industry of any nation.

Today, those things . . . the peace and freedom that hinge on farm production . . . are in the hands of you, the American farmer. *That* is why *soil conservation* is important both to you and to America.

Year after year more of America's future washes away—needlessly. Is anything being done about it? Yes, thousands of modern farmers like yourself are seeing the need for sound conservation practices and *are* attacking the problem. Typical are the farmers who have organized and manage 2300 non-political Soil Conservation Districts. Sure, it has cost them some money as an original investment. But ask a soil conservation man and he'll tell you that his land pays him many times over what he puts into it. Increased production pays back the principal plus increased yields. Then too, the generations of the future who will continue to live by the land, will benefit as even you do.

If you are interested in the program of Soil Conservation Districts, see your MM dealer today or write to the United States Department of Agriculture, Washington, D. C. Ask for complete information on establishing a soil conservation district in your neighborhood. You too, will find that the "Roots of Freedom" are in the topsoil . . . and they will be stronger because of you.

HELPFUL FACTS ABOUT SOIL CONSERVATION DISTRICTS

- Soil Conservation Districts are made possible by your own state laws.
- Operate independently of any federal law or regulation.
- Do not handle any such federal programs as marketing agreements, market quotas, acreage allotment or crop insurance.
- Get the conservation job done by local people through local effort in the American way.
- There is no charge for the technical and other district help that is available to apply a conservation plan to your farm.

MM MODERN MACHINERY

MINNEAPOLIS-MOLINE

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MANUFACTURERS OF THE COMPLETE LINE OF MODERN VISIONLINED TRACTORS, FARM MACHINERY AND POWER UNITS FOR AGRICULTURE

Nature in Print

By HOWARD ZAHNISER

"TIME and again Jesus went to nature and to the familiar plants of the countryside to adorn and garnish his parables and drive home his precepts," Alastair I. MacKay reminds us in his introductory chapter to a most interesting book he has written on *Farming and Gardening in the Bible*. "Our attitude towards the living soil is too mechanized," Mr. MacKay perceives, and with this volume he seeks to give a new vitality to Bible reading and at the same time show how our interest in the outdoors can be enriched from the Bible. It is a most welcome book to have been reading at the Christmas season and to have at hand as anticipations of March come to mind, for who can think of March without thinking of gardening, or of gardening and spring without thinking likewise of farming and of the rural countryside? And what reader is there who does not appreciate the grace of a literary charm added to his outdoor interests?

Mr. MacKay's treatment of the Bible, he himself describes as "a simple respectful effort to screen the words and phrases pertaining to agriculture, gardening, and animal husbandry, from the body of the text; then to arrange them in an orderly and natural sequence, as one would plan the layout of a balanced and diversified farm." Thus, introductory chapters are followed by separate discussions of gardens, herbs, trees of the forest and the field, fruit and nut trees, the vine, flowers, vegetables, field crops, the farmer's year, perfumes, spices, ointments, reeds and rushes, weeds, plant pests and disease, flocks and herds, poultry, pigs, bees, and draught, pack, and riding animals.

What an interesting and helpful book this would be for outdoor persons who are engaged in Sunday School or other activities that emphasize Bible study.

But all of us who read the book, whether we primarily enrich our outdoor interests with its lore, or find ourselves drawn through our outdoor interests into a reading of the Bible, can well profit by it. Mr. MacKay tells us that the preparation of the volume was made possible because the Rehabilitation Branch of the Canadian Government's Department of Veterans' Affairs assessed his literary ability as a major factor in his post-war rehabilitation, and it would not seem too extravagant to assess our reading ability with such a book as a factor in our own rehabilitation from the secular and jangling strain that most of us undergo in our urban, indoor, hurried living.

Of course, there are many ways for reading to ease the strains of modern living, and notable among these is the sharing that a good book brings us in the experiences of others that would seem so much better than our own at the moment. Who that loves birds and the seashore and the outdoors, for example, would not find a winter worry dissipated or crowded out of consciousness by C. F. Tunnicliffe's *Shorelands Summer Diary*? Mr. Tunnicliffe, who has been described as "Britain's foremost artist-naturalist," crossed with his wife on a March evening "over Telford's great bridge which spans the Menai Straits, and entered the island county of Anglesey" — not this time on a holiday excursion but as prospective settlers in this island on the northwestern coast of Wales, extending out into the Irish Sea. During the months that followed, from April through September, his *Shorelands Summer Diary* reveals, with a dual interest and charm, that he lived a life as close to the birds as shelter in a cottage and village companionships will permit. The sixteen water colors that are here reproduced in all the brilliance of the color that Mr. Tunnicliffe saw in bird and surrounding flowers, cliffs, waters, and skies, and the hundred and eighty-five other drawings throughout the text, which, like the great color plates, show also their artist's interest both in motion and in the peacefulness of quiet lives, are in themselves enough to charm us into a sharing of this shorelands summer. But along with these drawings is an account in words that also would by itself be quite sufficient to engage our companionship. As he closes his introductory essay, Mr. Tunnicliffe describes his late March walk along the sea wall, called locally the "cob:"

"On the far saltings the Curlew were calling and, as I watched, some of them came up the estuary and, flying almost overhead, continued up the marsh, suddenly soaring up and sideways as a shot rang out from a rabbiting farmer. Away into the distance of the marsh they sped, calling, calling all the way, an exquisite choir. I returned along the Cob, past the Welsh Black cattle grazing there, and, for a time, watched the homing gulls as they flew in formation down the marsh, over the Cob to their roosting place on the sands. Then, I, too, went homeward, full of hope and anticipation of riches to come."

Our own anticipations of riches to come, as readers of *Shorelands Summer Diary*, are never disappointed. Our acquaintance is made with many birds and, although many of them we never see in our own land, we seem nonetheless to value the knowledge gained through Mr. Tunnicliffe's observations and his skills as artist and writer. Our knowledge of shorebirds is especially enriched, as also are our knowledge and understanding of hawks. Perhaps, indeed, most notable in the summer's experiences and in this account of them are those with a family of peregrine falcons — the falcon, the tiercel, and the eyesses all sympathetically observed and shown in inspired water colors and drawings. Yet after all, the chief enjoyment in the reading and beholding of this beautiful volume is in our sharing a rich experience which Mr. Tunnicliffe has well savored and well interpreted.

In W. H. Murray's eloquent and fascinating account of *The Scottish Himalayan Expedition*, which he made in 1950 with Tom Weir, Douglas Scott, Tom MacKinnon, and their two dozen Dotial porters, we have another opportunity to ease the strain of our daily living, not this time in sharing quiet literary pursuits, or the composure of a summer by the shore, but rather by the purging excitements and challenges of mountain climbing and wilderness exploration in one of the great unspoiled regions of the Earth. "There creeps abroad throughout the land," writes our inspired author, "a grey spirit of shelter-seeking — a craving for security — the educated adult tending to ask of every venture he makes: 'Is it safe? Is it useful? Does it keep the wolf from the door?' " Mr. Murray disarmingly avows that "Himalayan mountaineering obviously is and does none of these things," and yet, pondering the experiences these mountaineers gained and the sense of wealth that Mr. Murray's testimony conveys to a reader, we may well wonder if we do not truly have here a much needed tonic for our too-gray spirit of shelter seeking. Thus, climbing Jatropani alone, "just to be alone on a hill in the sun," Mr. Murray sat down and watched for a while rhododendron trees and pines, and, writing later, allows us to share his experiences thus:

"I tried to let their beauty soak in," he writes (the beauty of the trees), "and when I did so a new beauty, something additional to all I had yet seen, seemed to shine out of them; out of the grass an added richness of green, out of the pines more fragrance of resin, from the blossom of the rhododendrons a glow of colour still brighter; unfathomable deeps and gentleness bloomed in the sky's blue. This newness taken on by the world was like that of something freshly created. Its loveliness had youth and vigour and an immortality so obviously not of its manifested

To A Whippoorwill

By MAY ALLREAD BAKER

When purple twilight steals across the land,
And all the countryside is hushed and still,
None but the lonely heart can understand
The eerie magic of the whippoorwill.

self, but of that ever new and ancient beauty, wherein all individual things have being and life, and which they serve. Five thousand feet under me, from the dark greens of the Nandakini Gorge up to the brown tip of the lammergeyer's wing, turned to the sky where it wheeled in thin pure air, and in all that lay between there was displayed the overwhelming harmony of things sharply strange and separate, that fully and from their beginnings were entered into one another and oned. How clearly this integrating principle of the universe disposed and flung forth His power that morning."

This Scottish Himalayan expedition seems, indeed, to have been a perfection of its kind. In four months of 450 miles of mountain travel it attempted nine mountains and climbed five, but it was not desperately devoted to an overpowering challenge, "had no intention of applying siege tactics to one mammoth peak." Rather it savored the wonderful country through which it moved to and between the mountains — "the most beautiful of the world's mountain country" — and confirmed Mr. Murray's belief that "the art of Himalayan travel — and indeed of all adventure — is the art of being bold enough to enjoy life *now*." This book in which the expedition is relived seems also a perfection of its kind — complete in details, clear in maps, vivid in photographs — and, most important of all, rich in its understandings of the beauty of the wilderness and its meaning to men, and eloquent in its communication with readers.

We return from this Himalayan expedition, as from the summer on Anglesey's shore, or from our literary indulgence in Biblical farming and gardening, relieved from our strains and refreshed for the day ahead. They are good books and can well introduce for us another spring.

Farming and Gardening in the Bible. By Alastair I. MacKay. Emmaus, Pa. Rodale Press. 1950. 280 pp. (6 by 9¼ in.), with frontispiece from an engraving of the Creation found in an old German Bible, index to Bible references, and subject index. $3.

Shorelands Summer Diary. By C. F. Tunnicliffe. New York: The Macmillan Company. 1952. 160 pp. (9¼ by 12 in.), with 16 full-page illustrations in color from water colors by the author, frontispiece and 185 other black and white drawings by the author in the text, and index. $8.

The Scottish Himalayan Expedition. By W. H. Murray. London: J. M. Dent & Sons Ltd. (New York: The Macmillan Company's importations department). 1951. xiii + 282 pp. (5 5/8 by 8 5/8 in.), with endpaper and 1 text sketch and 10 text maps by Robert Anderson, frontispiece color photo by T. Weir, 3 other color photos by D. Scott, 37 black and white photographs by Weir and Scott on 16 plates, glossary, lists of equipment, and index. $6.

NATURE MAGAZINE

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great Natural Resources of America

IN THIS ISSUE

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ANSS MEETS

By HELEN B ROSS

THERE is a direct ratio between the effective use of the mediums of public enlightenment and the interest in nature and conservation in any country or region," was the message brought to the recent St. Louis meeting of the American Nature Study Society by Roger Tory Peterson in his presidential address. To illustrate this point he compared the enthusiasm of people in England and northern Europe, where the best use of radio, newspapers and magazines is made, to the purely gastronomic interest in birds and wildlife of southern Europe, where education of this type is practically non-existent.

Dr. Peterson reported that, while we in the United States have the finest national parks and forests and the best game laws, our public education and public enthusiasm lags behind that of northern Europe.

His talk was accompanied by the premiere of the color film, "European Bird Adventures." Through it we had the opportunity to explore with Dr. Peterson; visiting the Peter Scott Waterfowl Sanctuary in England; traveling by horseback and mule in Spain to study herons, storks and egrets; climbing rocks in Scotland for fulmars and puffins, and watching the build-up of shore birds as the high tide came into the Dee River in Ireland.

Other speakers at the several sessions of the Society were Leonard Hall, outdoor writer of the *St. Louis Post-Dispatch*; Kenneth Morrison, National Audubon Society; Elizabeth Golderman, St. Louis audio-visual education specialist; E. Laurence Palmer, Cornell University; Howard Weaver of the Texas Forest Service; Winifred Haddock of the Brooklyn Botanic Garden; Earl Comfort of the Webster Groves Nature Study Society; Rex Conyers of University City, Missouri; Fran Williams of Carleton College; Charles W. Schwartz of the Missouri Conservation Commission, and John Gerard of Alton, Illinois, photographer.

A field trip concentrated on the ecology of the Missouri countryside and its plants and animals, and was under the joint leadership of Earl Comfort, Rex Conyers, Marshall Manger, Charles Mohr, E. Laurence Palmer, Roger Tory Peterson, John Wanamaker and Richard Weaver.

Roger Tory Peterson was reelected president for another year. Other officers elected were Ruth Hopson of Oregon, vice-president; Gilbert Mouser, treasurer, Helen B. Ross, secretary. Board members elected for 1953-1954 were Richard W. Westwood, Charles Mohr, Edwin Way Teale, Richard Weaver and Eva L. Gordon.

Mr. Mohr proposed an amendment to the constitution for action at the next meeting, which will be in Boston in December, 1953, that no board member shall be permitted to succeed himself in office.

VIRGINIA GARDENS

BY HELEN HAMLIN

HISTORIC Garden Week, to be held in Virginia from April 25 through May 2, offers much of interest to all lovers of Nature. Practically all forms of spring flowers plus, in some instances, many wild varieties of wild flowers indigenous to this climate, may be found in these gardens. From the grayish trunks of crape myrtle, growing as large as trees on the Eastern Shore, to the little woodland plants of hillside gardens in southwest Virginia, there is a great variety of plant life to be studied. If one wished only to see the great masses of boxwood — a word almost synonymous with Virginia gardens — a trip to this State would be worthwhile. Plantings of this evergreen shrub frequently date back to the eighteenth century, and, as a consequence, long alleys lined with great masses of the thick broad shrub may be seen in many gardens, in addition to the tall specimens of the popularly labelled "tree" box. Many of these gardens, privately owned, are open to the public only at this time.

In keeping with these plantings of boxwood, many gardens are devoted exclusively to the plants and flowers cultivated in the eighteenth century. Kenmore, the home of Betty Washington Lewis, is a charming example of this type of planting. Also to be seen here, as well as in many gardens near Charlottesville, is an herb garden. These plants, too, are confined to those listed in the eighteenth century, and, in the particular instance of Kenmore, all herbs were brought from the home of Betty Washington's brother at Mount Vernon.

The gardens at the University of Virginia have recently been restored by The Garden Club of Virginia, with the proceeds of Historic Garden Week, according to the original plans by Thomas Jefferson. A visit to any of these old or restored gardens, therefore, becomes a lesson in eighteenth century horticulture.

In addition to seeing old gardens, the Nature lover should allow, if possible, an extra day for a drive on either the Skyline Drive or on the Blue Ridge Parkway. At this time of year, redbud and dogwood are to be seen in full bloom depending upon the altitude of the Drive at that particular point. Other wild flowering plants are also abundant.

Virginia hillsides and Virginia gardens, radiant with spring bloom, offer deep gratification to the eye of the artist or of the botanist. No flower lover can afford to miss the spectacle.

PHOTOGRAPH BY RALPH R. THOMPSON

A detail of the restoration work carried on at the University of Virginia by the Garden Club of Virginia with funds made available through Historic Garden Week.

RATTLESNAKE NOISE

C. D. WAGONER

How much noise does a rattlesnake make? Until science recently lent a hand the answer generally was in line with the excitement of the person who accidentally came across one. J. L. Michaelson, General Electric engineer, found a three-foot, seven-inch rattler up on Tongue Mountain in the Adirondacks of New York State. He skinned it and saved the rattle.

A day or two later, when making some sound measurements on war materials in the laboratory, he tied the rattle from the snake to an electric vibrator before the microphone of a noise meter. He started the apparatus going, looked at the gauge and read 75 decibels. A decibel is the scientific unit of measurement of noise.

Seventy-five decibels is equivalent to the overall noise which might be caused by a half-dozen typewriters all in operation at once, or to the rattle of dishes in the cafeteria of a restaurant. "However, in all fairness to the snake," Michaelson pointed out, "the rattle was placed close to the microphone of the sound meter, whereas in my comparison I refer to the overall noise, not a close-up."

So now the sound of a rattlesnake is known. Not that it will make any difference if one should attack you, but it is well to know these things. At least that is the way engineers figure it out.

Your Blood

Your Blood and You. By Sarah R. Riedman, with a foreword by Dr. A. J. Carlson. New York. 1952. Henry Schuman. 130 pages. Illustrated by Ida Scheib. $2.50.

"The blood is the internal environment of all the organs of the human body," says Dr. A. J. Carlson of the University of Chicago in a foreword to this interesting book. "Modern biology and medicine have discovered scientific methods by which we can, through studies of the blood, reach a significant understanding of how our body organs work in health as well as in disease, including infectious diseases." Thus, in this book, the author presents blood as an introduction to knowledge of how the human body functions.

Orchids

Philippine Orchids. By Reg S. Davis and Mona Lisa Steiner. New York. 1952. The William-Frederick Press. 270 pages. Illustrated. $5.00.

There is a rich orchid flora indigenous to the Philippine Islands, and in this book the authors describe in detail one hundred of the native species. Both authors are orchid specialists and intimately acquainted with the islands where these lovely plants are found. This is a book for the general horticulturist and the amateur orchid enthusiast.

Ed Dodd in Movie

Ed Dodd, creator of "Mark Trail," is featured in a new, 30-minute, non-commercial color movie entitled "Water Wilderness" and brought out by the Western Auto Supply Company, 2107 Grand Avenue, Kansas City 8, Missouri. The film is available to clubs and organizations at no charge. It shows a variety of fishing and wildlife incidents deep in the Everglades. Mr. Dodd is shown in quest for material as background for his "Mark Trail" sequence.

Contents Noted

WILDLIFE Management is a new Boy Scout Merit Badge, bringing up to date the information supplied future citizens with respect to our wildlife resources and the modern approach to their administration. Author of the new Merit Badge pamphlet is Durward L. Allen, Biologist of the U. S. Fish and Wildlife Service. Mr. Allen has done a splendid job of condensing into some ninety pages a popular discussion of present-day thinking about the management of our wildlife resources, and the land and the forest, marsh and field that they occupy. Wildlife management is, of course, practiced to the end that more game birds and mammals, more fishes, more furbearing animals, may be available for those who find pleasure in gunning and fishing, and profit in trapping. Perhaps it is not supposed to have any place in this subject, but we feel that there might have been injected, here and there, a little more suggestion that our wild birds and mammals are also interesting to see, photograph and to have around just for themselves. Perhaps this attitude will be a by-product in the viewpoint of the Scout who studies to earn this Merit Badge. We hope so.

ON THE Virginia shore of the Potomac River, about a dozen miles from the national capital, is a place known as Dyke Marsh. To the fresh or brackish water of its winding waterways and broader channels come many birds. It is a nesting place or resting place for a wide variety of species, from eagles and great blue herons to warblers, many of which find the area hospitable to nesting. The northern half of the marsh is owned by the Federal Government and is under the jurisdiction of the Office of National Capital Parks of the National Park Service. The rest of the marsh is owned by the Smoot Sand and Gravel Company, which also owns or leases great stretches of the Potomac banks for their sand and gravel values. The company has been most cooperative in holding off exploitation of the marsh, and has offered to trade, at no advantage to itself, the marsh acreage for land now owned Federally and used by St. Elizabeths Hospital for mental patients, some of whom farm the land. Hospital authorities have thus far refused to make any such trade and Dyke Marsh, the last such area near the capital, faces early destruction. Marshes, unfortunately, seem to be appreciated only by the wild creatures that find sanctuary and natural habitat within them, and by those people who enjoy the plants and animals of such areas. So the march of "progress" has seen marsh after marsh drained and destroyed. In some parts of the country large marshes, turned out to be of no value to agriculture, have been acquired by government and returned to their natural function as homes for wildlife. Loss of Dyke Marsh would be a tragedy, for it is an asset to the Capital area, the real value of which probably will not be fully appreciated until it is irreparably lost.

HATS off to *The Miami Herald* and to its associate editor, John D. Pennekamp, for the determined fight that he has put up to keep the State of Florida from going back on its pledge to the Federal Government with respect to oil leases on Everglades National Park land. Speculative oil interests have put pressure on the State to extend oil leases, and grant new ones, on land that was donated for the Park with the understanding that such extensions and grants would not be allowed. Mr. Pennekamp has carried on a sustained program of public education on the issue, holding that the people of Florida gave this land with no strings attached, that they are now realizing the value of the Park to the State and the Nation, and that they must not go back on their word. Other Florida newspapers have joined with this conservation-minded editor, and it now appears that public opinion will win again in the face of selfish interest.

INCREASING numbers of people who are fortunate enough to own acreage of wild or semi-wild land are seeking some way of keeping such areas in a natural state in perpetuity. After years of living with such a possession one becomes attached to it, and to the plants and animals that live there, too. Preservation of such areas is not simple, and assuring their future safety is often even more difficult. Recognizing such a demand, the Nature Conservancy, 1840 Mintwood Place, Washington 9, D.C., has just prepared a bulletin that it entitles "How to Preserve An Area." This is a concise and practical discussion of this problem, and copies are available on request.

MANY bills of interest to conservationists were tossed into the legislative hopper as soon as the Eighty-third Congress convened on January 3. Some of these are measures that made some progress in the previous Congress; others are new. We will have more comment on these later. However, two bills of particular interest have been introduced by Congressmen Leroy Johnson of California. One of these, H.R. 1038, was before the Eighty-second Congress and would place a blanket prohibition on dams or other big water-engineering projects within or affecting any national park or monument. The other is a new bill, H.R.1037, and provides for the creation of Green River Canyons National Park from a portion of Dinosaur National Monument in Colorado and Utah. This area includes the controversial Echo Park and Split Mountain dam sites sought by reclamation interests and opposed by conservationists. Both bills would be a step forward if enacted into law. R.W.W.

Llamas in the Andes carrying supplies to an isolated gold mine in the mountains. The sacks are lashed on the backs of the animals with llama-hide rope.

Ships of the Andes

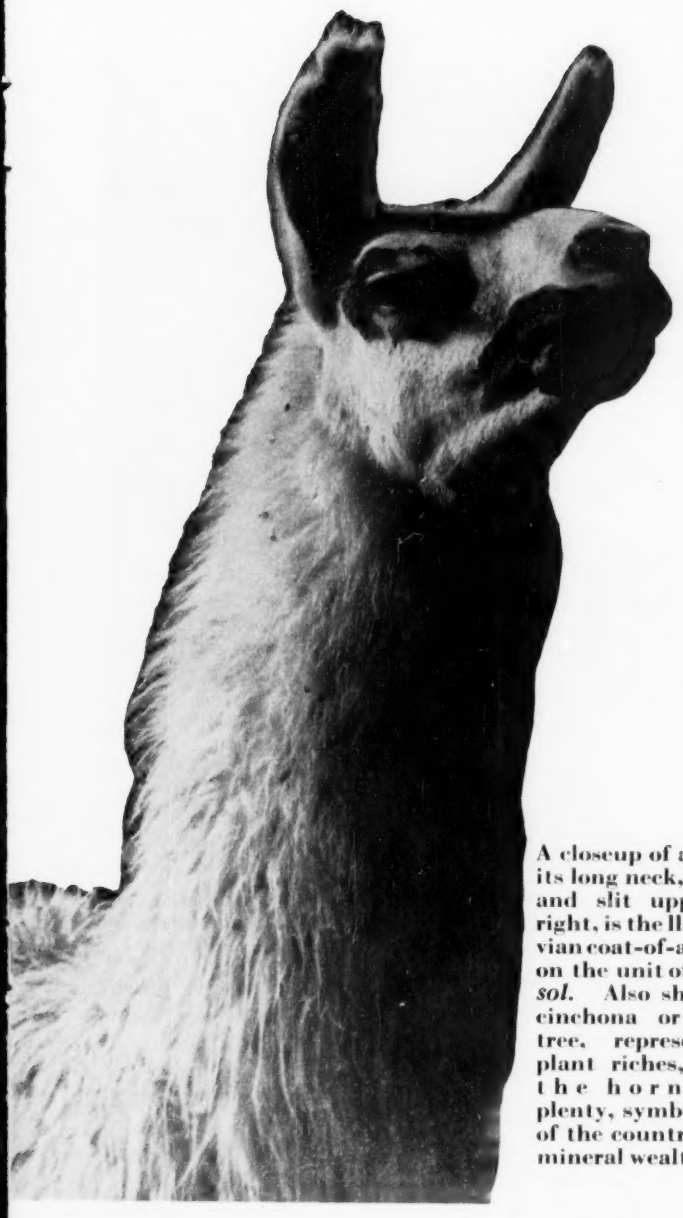
By HENRICKS HODGE

Photographs by the Author.

The position of the llama in the New World remains unique. It is this hemisphere's only native beast-of-burden and it is one of but three native animals brought into domestication by American Indians. The muscovy duck and the guinea pig are the other two members of this American triumvirate. In importance llamas stand head and shoulders — figuratively and literally! — above these other all-American domesticants, for llamas are all-purpose animals. Although primarily beasts of burden and sources of wool, they also supply palatable meat, yield a tough, useful hide, and, last but not least, much needed fuel in an otherwise fuel-less land.

Save for the lack of a hump, llamas look like camels. Actually llamas *are* camels, one of the group of South American cameloid stock which includes such close relatives as the alpaca, guanaco, and vicuña.

Llamas are the largest of the Andean camels, although they stand only three to four feet high at the shoulder. The long neck and camel-like head, however, give them an overall height of around six feet, and the impression of being a much taller animal. The large black eyes possess soft and expressive pupils. Typical is the well-marked slit in the upper lip, like that of an Old World camel. The lower lip tends to droop a bit, especially with age. This characteristic, along with the amount of wearing shown by the teeth, enables the highland Indian to estimate the age of an individual llama with apparent accuracy.



A closeup of a llama, showing its long neck, camel-like head and slit upper lip. Below, right, is the llama on the Peruvian coat-of-arms as it appears on the unit of currency, the *sol*. Also shown is the cinchona or quinine tree, representing plant riches, and the horn of plenty, symbolic of the country's mineral wealth.

PROBABLY no single animal of the western hemisphere played so important a part in an American civilization of pre-Conquest days as did the llama. For, although its origin and earliest domestication are lost in antiquity, the later history of this animal, and its importance among the Incas, are well known. It is no mere coincidence that these people and the llama shared a common range. Edible, high-altitude crops like the native potato were important, of course, but without the warmth of llama wool no civilization like that of the Incas could have endured for long in face of the low temperatures endured in the high Andes.

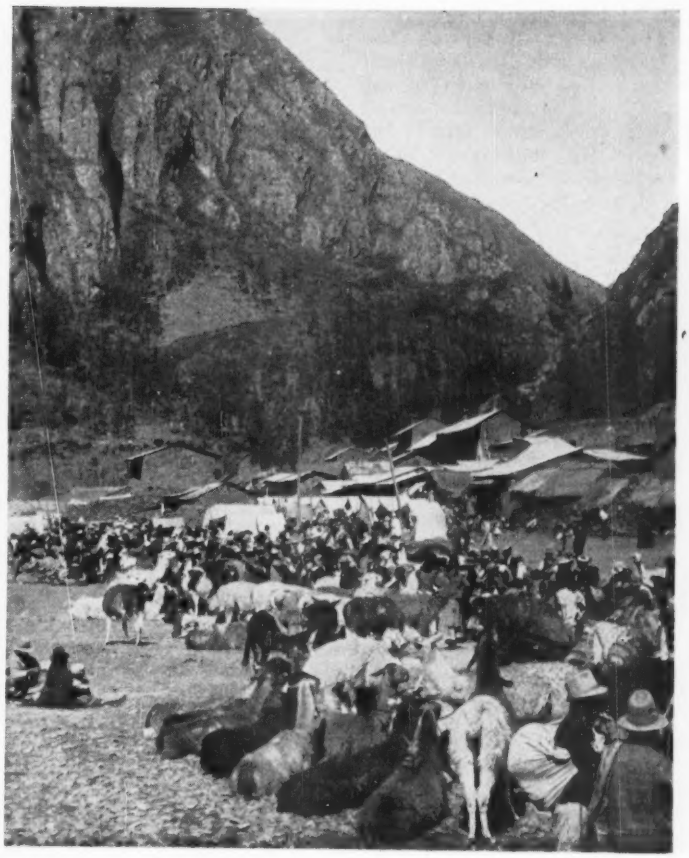
By Inca times the llama had long since acquired all the signs of a long-domesticated, tractable, and docile

Despite an Andean blizzard at an elevation of 16,000 feet, llamas graze or drink on the high *puna*. In the foreground is a ewe llama with its lamb. The young are born in February or March, when the weather on the high pastures leaves much to be desired. Young llamas thus become hardy early in life.

human friend. In pre-Conquest days, besides serving as sure-footed pack animals, they constituted the principal source of meat for the realm. The flesh was distributed to the common folk who, then as now, sliced it thin and dried it in the sun. The Peruvian name of the product, *charqui*, borrowed by English-speaking folk and corrupted to "jerky," is now widely used for any similarly prepared meat, whether llama or beef. The tough fleece, though not as fine as that of the alpaca, nevertheless served the masses as the primary material from which to weave ordinary clothing and blankets. At the proper season all llamas were sheared and the wool was deposited in the public storehouses, from which it was parceled out to every family, each according to its needs.

As with gold, silver, and the sacred coca leaf, certain llamas were royal perquisites, reserved exclusively for the Sun and for the Inca. Experienced shepherds saw to it that the royal flocks received the proper pasturage, moving them to more favorable grazing with the season whenever necessary. The regulations for the husbandry of what the conquering Spaniards called "Peruvian sheep" were so advanced that they even provoked the appreciative admiration of Pizarro and his men, many of whom were good judges, being familiar with the management of the great flocks of merino sheep in Spain.

The esteem in which llamas were held by the Incas is indicated by the fact that they were considered supreme among sacrifices for the numerous religious festivals celebrated throughout the Inca year. Thousands were offered up annually, but these were always males for, under their strict rules of husbandry, females could not be killed. Each god, each festival, and each season required a special type of sacrificial llama, and so the flocks were carefully bred along strict color lines and wool markings. Brown-colored llamas were usually sacrificed to Viracocha, the supreme god of the Incas; pure white llamas, which were also symbolic of royal authority, were destined for the Sun, Viracocha's principal servant and the divine ancestor (it was believed) of the Inca dynasty; while parti-colored llamas,



To the weekly Saturday market come Indians and their pack llamas, bearing produce from their far-flung huts. The animals rest while humans barter. Note the rugged terrain that necessitates packing by llama.

with perhaps the significance of clouds on their blotched fleeces, were offered to Thunder, the god of Weather. Even today llama offerings still persist among the highland Indians, white llamas being sacrificed on important occasions among the *Aymara*, one of the tribes living on the high *altiplano* around Lake Titicaca.

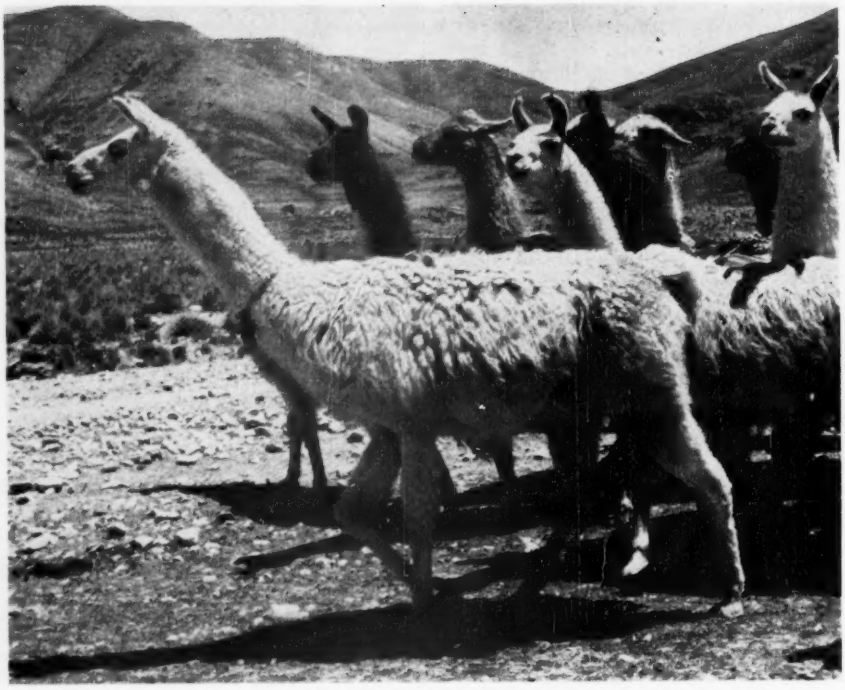
Although llamas are being replaced, even in their homeland, by immigrant beasts of burden such as horses and mules, they are still abundant. They range all the way from Riobamba in southern Ecuador to the highlands of Bolivia, where they are numbered in the millions. More than a domesticated animal, the llama is an associate of the highland Indian. More than an instrument of work, he is a companion of labor. Beast of burden above all, the mountain Indian utilizes the beast completely, from its finest wool fiber to its most insignificant dropping. Its meat nourishes him, its wool clothes him, its skin covers his feet, its grease serves him in making crude candles, its hair to make rope, while its excrement, once dried, provides him with a fuel to warm his body when numbed by the cold. But, above all, the llama is a beast of burden, and where the trail becomes, as it often does, too rough for even a mule, then this little camel "takes over." Under such circumstances the tiny cleft hoofs, with their claw-like nails, give excellent footing whether on rock, slippery ice or snow.

What is even more to the point, pack llamas represent efficiency itself. Horses and mules, to give their best, must be grain-fed, watered, shod, and equipped with special saddles and girths. Llamas need none of these. Like his cousin camel, a llama can go for long periods without water. Of equal importance, he can work on minimum food rations. These are eaten "on the job," for as they travel llamas feed on the coarse, yellowish bunch grasses called *ichu*, which everywhere dot the *altiplano*. Pack saddles, saddle blankets and girths are unnecessary since they are "built-in". . .the thick wool is a protective and resilient covering, which effectively insulates the animal's body from any bruises caused by his load. Cargo is usually packed in saddlebags of plain woven wool, and fastened snugly with a rope made of llama raw-hide.

Surefootedness, not strength, is their forte, for the best llama cannot carry much more than half of a good mule-load. But what they lack in individual strength they more than make up in number, for a llama flock may include a thousand animals. An average-sized llama can pack sixty-five pounds for twelve to fifteen up-and-down miles a day, even at rarefied elevations up to 17,000 feet, where an ordinary man or beast would pant for breath. An occasional stocky beast can carry up to 130 pounds, but the limit of these little camels depends on the strength of the individual and not on any hypothetical one-hundred-pound limit. Only males are utilized as pack animals, and these begin their working life at an age of about three years, when they are started out with small loads. Only when the animal is sufficiently mature and strong does it graduate to packing maximum loads.

Much has been said concerning the llama's ability to detect overloading. In the first place, they often resent being handled during packing and sometimes emit much deep-throated rumbling and grumbling. Loading a group together seems to make the process more congenial. It is true that if severely overburdened llamas will lie down and refuse to budge. Under such conditions llamas sometimes spit in protest, and usually with unerring aim and disheartening results. Instead of simple saliva the charge is a green mass of half-digested grass, which is usually ejected from both mouth and nostrils with explosive violence.

Few pack animals move with the supercilious grace of llamas on the trail. Heads erect and alert, they remind one of tourists admiring the rugged scenery. With dainty tread they move slowly, majestically, silently, and almost solemnly, following one animal who is the natural leader of his flock. In keeping with



The white llama in the front is the lead animal, natural leader of the flock. As such he carries a small bell on his neck, and to his ears are attached short, colored, ownership tassels.

the tenor of his wards, the Indian herdsman — often on llama-hide sandals! — pads behind his flock, encouraging them forward with an almost imperceptible low whistle. This is a far cry from the boisterous blasphemy which Andean muleteers bellow at their equine wards. After a hard day's work the exhausted llamas lie down, tucking their legs almost mysteriously under them, catlike, for a much-deserved snooze. Even in such repose their heads remain erect and they pass the time chewing their cuds, cowlike, with what has been described as "an expression of constant contemplation such as one often observes in confirmed smokers."

Llama babies come into the world in the months of February and March, when snow-squalls or cold rains are still common upon the highland pastures. At such times it is amazing to see newborn llama lambs gamboling about on a light blanket of snow. As though to insure against infant mortality, only a single lambkin is produced, and in this way the small quantity of milk produced by the mother does not have to be shared by more than one youngster. The scantiness of the milk supply in llamas was undoubtedly the chief reason why these Andean camels were never developed as dairy herds in Inca times.

Since the *puna*, or high plateau, serves as a common, unfenced pasture for all the flocks of the community, some means of denoting ownership must be given individual animals. Thick fleeces do not lend themselves to branding, so, instead, the wool on the middle of the back is often blotched with bright-colored dyes, a different color for each family. Sometimes bits of wool tassels of various bright-color combinations and lengths are attached to the ears. When so decorated llama flocks look for all the world like a group of dowagers sporting pendant earrings. The simile is the more apparent during fiestas when Indians, themselves dressed in bright festival regalia, similarly bedeck their favorite lead llamas with all sorts of colorful trappings, even including tinkling bells.

The mutual love and esteem for the llama, which began with the ancient Peruvians, continued down through the centuries. The conquering Spaniards, recognizing the value of such beasts of burden, continued the special protective legislation originally accorded llamas by the Incas. With the advent of national independence from Spain, the republics of Peru and Bolivia whose modern boundaries encompass the heart of "Llama-land," gave these four-footed favorites a lasting place of honor on their national coats-of-arms, where, as heraldic symbols, llamas now associate with rampant lions and double-headed eagles. But far from being a mere symbol, and unlike these other more or less fanciful creatures, the llama stands as a living part of Peru, and Bolivia, today as well as yesterday.

★

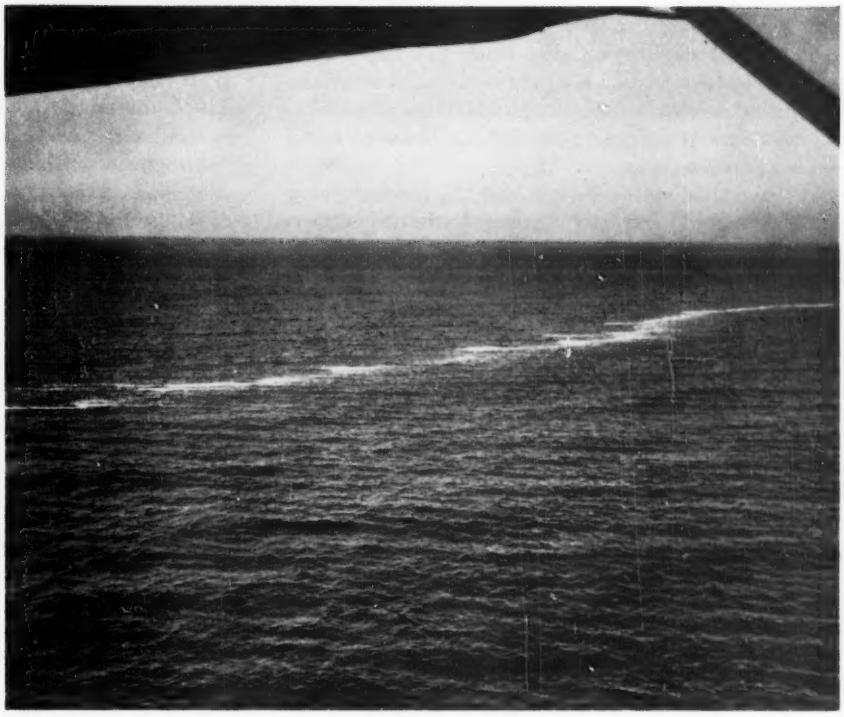
Curiosity

By JANE MERCHANT

I wish I knew who spins the filmy light
Of moonbeams into milkweed's silken white,
How spiders plan their geometric sewing,
And what the wind does when it isn't blowing.

The Red Tide Hits and Runs

By E. JOHN LONG



Dead fishes, victims of the mysterious "red tide," form a ragged line on the surface of the Gulf of Mexico off the Florida coast.

PHOTOGRAPH FROM THE ST. PETERSBURG TIMES

WHEN newspapers and radios flashed the word in mid-November that the "red tide" was strewing the Florida Gulf coast with dead and dying, neither the Pentagon nor Civil Defense seemed alarmed or took any notice.

But scientists of the U.S. Fish and Wildlife Service, of the University of Miami, and of a dozen other institutions interested in fish and other marine life sprang for their files, sampling bottles and field equipment. Marine biologists from Miami hastened to Gulf ports. A government laboratory boat put out from Galveston, Texas, and a Coast Guard plane from St. Petersburg. Private planes from Fort Myers hurried to the scene to conduct first-hand observations and experiments.

Although the "red tide" has nothing to do with the Communist menace, in the naturalist's book it is just as subversive, and just about as mysteriously devious in its ways. And, although it is a nickname for rust-colored sea water, the phenomenon has no connection with the tides, high or low, other than hitch-hiking a ride with them.

The actual *origin* of the "blooming" of the sea (and the simultaneous mass killing of marine life) is still a matter of some doubt. But we do know this: Red coloring, in many instances, is the result of an enormous and rapid increase of tiny bits of living matter called dinoflagellates, particularly of the genus *Gymnodinium*. Just where they come from no one knows, because under normal sea water conditions they are not found. Where they go, or what vestige of them survives in the irregular intervals between visits, are equally mysterious.

When they discolor the blue waters of the Gulf of Mexico, however, countless thousands of dead fish soon come to the surface, and if the wind is from the west, their dead bodies wash up in long windrows along the beaches. As reddish surf rolls in, residents of the shoreline complain of an odorless, highly irritating "gas" that causes a burning sensation of the throat and watering of the eyes. All this is in addition to the fearful stench of bloated, decaying fish, and the annoyance of myriad black flies they attract.

Little wonder, then, that not only scientists, but conservationists, sportsmen, commercial fishermen, and public health and other civic officials as well, rush to battle stations when the dread word comes that the "red tide" is running again along the Gulf coast.

Before any really effective measures can be taken against it, however, scientist and layman are agreed that much more must be learned about *Gymnodinium brevis* — the suspect's full name — its characteristics, habits, likes and dislikes. During the last big invasion, in 1946-47, government scientists were caught with their appropriations down, but the Marine Laboratory of the University of Miami, the Woods Hole Oceanographic Institution, and other private research bodies, did noble yeoman work. It was a scientist of Miami's Marine Laboratory, Dr. Charles C. Davis, who first identified and named the microscopic organism found in samples of sea water from the infested area.

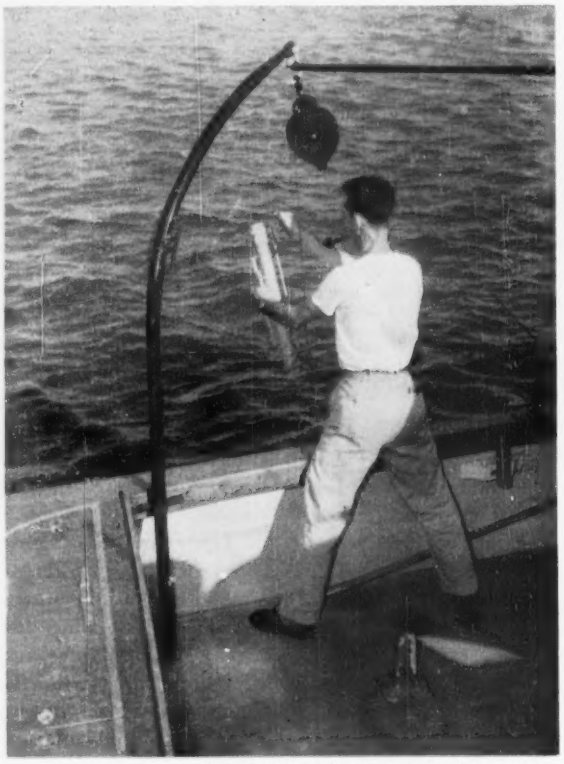
Since then funds have been forthcoming, and the U.S. Fish and Wildlife Service operated a research station at Sarasota, Florida, for three years, until its activities were consolidated with the Service's larger laboratory at Galveston, Texas. Throughout the interval between 1948 and 1952, studies were carried out

ashore and afloat, the latter with the aid of the *Pompano*, converted air-sea rescue craft, and the *Alaska*, a larger vessel equipped with chemical tanks as well as equipment to sample and measure Gulf water salinity, temperatures at various depths and variations in chemical composition.

As a result of these studies, and the research being continued at Miami and elsewhere, the November, 1952, running of the "red tide" offered the first good chance to test theories and speculations that had developed in laboratory tests, and even to experiment a bit with certain control measures.

Whether the application of the latter had any connection with the *brevity* of the visit made by the ornery little critters, and whether the measures taken will prevent or postpone future visitations, remains for time to determine.

At any rate, scientists learned more about the "red tide" in a short period than ever before, and they obtained a much larger number of water samples and fish victims for further study under controlled laboratory conditions. Because an east, or offshore, wind prevailed throughout most of the week the "red tide" was in evidence, the number of dead fish washed up on the beaches was less than usual — a welcome break for Gulfside residents and visitors. Bulldozers soon took care of fish victims that came in near developed areas.



UNIV. OF MIAMI MARINE LABORATORY PHOTO

A Nansen reversing water bottle samples water at various depths and records the temperature at the sampling depth. Such a device was used to obtain data on the "red tide."

Although we have heard and read about the "red tide" only in comparatively recent years, it should be understood that the phenomenon itself is not new. There are scientific reports of mass destruction of fish along the west coast of Florida, some of it associated with red water, in 1844, 1854, and 1880.

According to Dr. Paul S. Galtsoff, of the Branch of Fishery Biology of the U.S. Fish and Wildlife Service, early students of the "blooming of the sea" attributed its lethal powers to various causes, ranging from "noxious and poisonous gases. . . . .derived from underground streams of water that flow into the sea," to "cold waters of the deeper part of the Gulf, brought near the surface, where they affect the fish; the sudden chill producing such a shock as to cause either death or temporary disturbances of health."

The next recorded appearance of the "red tide" with great destruction of fish was 36 years later, in 1916-17. There was an almost equally long interval before the visitation of 1946-47.

Fishermen working off the coast near Naples, in November, 1946, were the first to report large streaks of reddish-brown water, 10 to 14 miles offshore. Fish entering these discolored patches quickly died, and soon the surface of the water was covered with dead and dying fish. The trouble area rapidly grew, extending north to Sarasota. By January, 1947, the bay and beaches of Fort Myers, Captiva and Sanibel Islands, and other Gulf waterfront communities were littered with millions of dead and dying forms of marine life, presenting a serious health and disposal problem.

The Marine Laboratory of the University of Miami and the Woods Hole Oceanographic Institution participated in such field work as time would permit. Doctors F. G. Walton Smith and Gordon Gunter, of the Miami Laboratory, immediately set out for the afflicted area, collected samples of water and made such observations as they could before the sea returned to normal in March. Water samples were sent to Woods Hole for analysis.

Quite unexpectedly the "red tide" returned during the summer of 1947, and more sampling of water, plankton, and fish was done by the Miami Laboratory and Woods Hole, as well as by the Fish and Wildlife Service, and the Food and Drug Administration of the Federal Security Agency. As yet, no one could offer any real solution to the "red tide" mystery, but much of the little we know of the pestilence springs from this period. What does the "red tide" look like? From a boat approaching an infected area the change in color may be gradual from the clear, blue water of the open Gulf to a slightly turbid and yellowish hue. Or, the line of demarcation may be sharp, as though an invisible curtain were separating the blue from the colored water. The color itself can range from green, greenish-yellow, yellow, amber, reddish, red to brown.

In the wake of ships penetrating the area the water has an oily appearance. When dipped up and allowed

to stand for five to ten minutes it becomes slightly thick, of the consistency of corn syrup, and slimy to the touch.

From the air the reddish patches are more pronounced, but the intensity of the color is not uniform. Patches may range from a few square feet in area to strips elongated by offshore currents to several hundred feet. Silver flakes are dead fish, bottoms up. Sometimes their bodies crowd so closely together that they resemble ice flows.

On the beaches of the lower west coast of Florida, particularly during the 1947 summer appearance of the *Gymnodinia*, the havoc — and smell — was indescribable. Windrows of dead fishes piled on the sand included most of the common commercial and non-commercial species. Large numbers of shrimp were seen, as well as more-than-usual numbers of the remains of blue crabs, fiddler and mud crabs, barnacles, oysters and coquinas; also some porpoises and turtles.

While an accurate estimate of the quantity of fish killed is hardly possible, the total no doubt ran into millions of pounds, enough to reduce the catch of commercial fishermen considerably in what is normally one of the Gulf's important fishing grounds. Virtually all species were affected, although scientists were puzzled by the absence of the pelagic, such as mackerel, bonito, etc. Local fishermen explained that mackerel will not float when dead, and their claim was borne out by sponge divers, who found the bottom littered with dead mackerel while they were working off Marco Island the following winter.

To other mysterious aspects of the "red tide" must be added a strange "gas" that accompanies each visitation. Even before the stench of decaying marine life makes the lot of residents of Gulf beaches and islands almost unbearable, they have noticed that an onshore wind and heavy surf bring an *odorless* but highly irritating "gas," that causes coughing, sneezing and suffering from symptoms like those of a heavy cold or hay fever.

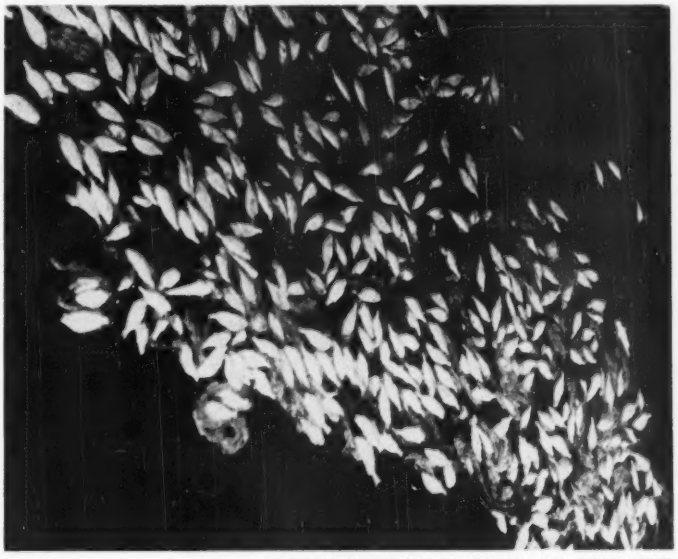
Some residents have a simple explanation, avowing that the Army dumped Lewisite and mustard gas shells into the Gulf far offshore, and that currents are carrying it to land. A nice theory, except that the Army has no record of any such dumping in the area, and the same symptoms were noted during the red tide and fish mortality in 1916.

While laboratory tests have thus far failed to identify the "gas," it has been determined that a pad of absorbent cotton, held over the mouth and nose, is sufficient to prevent irritation. This indicates that the source, as it exists in the air-borne form, is filterable and therefore is probably present as a liquid or minute solid. Further, it is quite stable. Samples of red water collected in July and stored for several weeks were still able to produce a positive coughing reaction in humans.

Although fishermen have given vivid descriptions of the manner in which fish die when they encounter the lethal tide, science still seeks a satisfactory answer to "Why?" All agree that death comes with merciful swiftness. As the fish enters the red water it begins to act strangely, "coming to the surface, whirling around, then turning on its side or lying stomach up, sometimes sinking to the bottom." Some observers describe a gulping of air by fish, as if it lacked oxygen.

Dead and dying specimens, (mostly thread herrings) sent to the Maryland laboratory of the Fish and Wildlife Service for study, were dissected and the internal organs carefully examined. Gills were *not* clogged by plankton *or other materials*. If death were due to asphyxiation, it was not caused by occlusion of the gill filaments.

The prevailing theory is that death is due to some strong poison produced by or associated with red plankton. The poison, it is believed, attacks nervous centers controlling both equilibrium and respiration.



PHOTOGRAPH FROM ST. PETERSBURG INDEPENDENT

Closeup of dead fishes killed by the "red tide" and floating on the surface. Onshore winds wash up great windrows of dead marine life, creating a health and disposal problem.

Reports that seagulls and other shore birds died as a result of eating marine life contaminated by the red tide led to shipment of a barrel containing reputedly poisonous hard shell clams and fish to the Maryland laboratory. But toxicity tests for both clams and fish were negative, and the fish showed only a strong odor of iodoform in the gills.

Which brings us to the $64 question: What are the most up-to-date theories about the cause and cure of the "red tide"? Even before the November outbreak, scientists had pieced together the known data about the phenomenon and had come to these general conclusions:

(1) There seems to be some connection between a

change in the salinity, or salt content of sea water, and the sudden appearance of *Gymnodinium brevis*, the tiny organism that gives the water its red color. Laboratory tests of samples are still being run.

(2) Because water samples taken in normal times do not show any evidence of *G. brevis*, it is believed by one group of scientists that the organism may be a variant of another, perhaps harmless, form of microscopic sea life.

(3) While sea samples taken during "red tide" infestations show an excess of nitrogen and phosphorus, it is not believed that these alone can bring about a sudden multiplication of the organism *G. brevis*. Laboratory tests may shed some light on this.

(4) The "red tide" often, but not always, follows a period of heavy rains and a very calm sea.

(5) The favored "birthplace" of the plague seems to be in a 400-mile square area of the Gulf, south and west of Sanibel Island, and not too far off the mouth of the Caloosahatchee River. Coastal currents and the wind may carry the "tide" and its victims north; in one instance dead fish were seen as far up the coast as Clearwater and Tarpon Springs.

(6) *G. brevis*, it was found in laboratory tests, can be killed by any one of a dozen chemicals now on the market, a copper sulphate solution being the most practical.

(7) The organism will disappear as suddenly as it came if a storm or a high wind disturbs the contaminated area.

(8) Certain laboratory tests show that dinoflagellates cannot be cultured in artificial sea water without the addition of a medium soil extract (water containing ordinary soil). This, however, is true of many cultures, and a definite conclusion awaits further laboratory tests, now being conducted at Galveston, Miami and elsewhere.

All of which adds up, according to E. H. Dahlgren, Chief, Section of Marine Fisheries, of the U.S. Fish and Wildlife Service, to the possibility of a connection between the appearance of the fish-killing "red tide" and abnormally heavy discharges of fresh water from the rivers of the southwest coast of Florida, mainly the Caloosahatchee and the Peace Rivers.

These overflows, spreading out into the Gulf in a period of calm, form layers or surface pools of comparatively fresh water containing certain soil extracts. The unbalance in salinity and other chemical content set up, it is believed, brings *G. brevis* into being, and the consequent killing of fish.

The theory finds support in the observations of another Fish and Wildlife scientist, Dr. John F. Howell, who made an aerial and surface survey of the infected area in November. He reports that he noted a point about 15 miles off Sanibel Island where there seemed to be a definite barrier to the dead fish going farther westward in the Gulf of Mexico, although the wind was blowing that way. Howell said there was no physical barrier, such as a reef, and speculated that the water might be saltier there.

Dr. L. Basil Slobodkin, also a Fish and Wildlife scientist, is investigating the possibility of Lake Okeechobee being a factor. One of the outlets of the big lake is the Caloosahatchee River, and the flow was exceptionally heavy after flood conditions in the lake area during October. Water from the lake has a strong soil extract content.

As for measures to control, or to prevent, future outbreaks of the "red tide," scientists consider this a difficult but not impossible task. Some progress has been made in Japan, where a similar pestilence threatened the pearl oyster industry. Both American and Japanese biologists have known for some time that dinoflagellates, like other protozoa, are sensitive to copper sulphate and hypochlorite.

A copper sulphate concentration of 1 part per million was used by Japanese biologists to control a red water invasion of Gokasho Bay and in the Gulf of Konsa. The copper sulphate was applied by attaching bags filled with the salt to the sides of motor launches, which were run back and forth in the bay. The churning of the water by the propellors themselves may have aided the project. At any rate, large numbers of destroyed dinoflagellates were later found floating on the surface.

To prevent the growth of bacteria that might develop after the destruction of the dinoflagellates, the Japanese employed a 10 percent solution of calcium hypochlorite. An interesting sidelight on the Japanese experiment was the appearance of a new type of dinoflagellate, apparently harmless to oysters.

The *Alaska*, laboratory ship of the U.S. Fish and Wildlife Service, arrived at the infested Gulf area last November from Galveston with 15,000 gallons of saturated copper sulphate solution. This was only a drop in a 400-square mile bucket, and time alone will tell whether it had any lasting effect. Dr. Smith, of the Miami Laboratory, feels that the cost of spraying may be prohibitive, and that the value is highly problematical.

The matter of "disturbing the waters," to break up pools or patches of low salinity, is being given further consideration. Although it was not tried, a suggestion was made that the Navy and Air Force be asked to bomb the red patches at sea. While this would undoubtedly kill some fish, too, the promoters of the idea believe that depth bombs could upset the balance between fresh water and salt, and bring about normal sea conditions in which dinoflagellates cannot overgrow.

Findings of the experiments still in progress are being eagerly awaited, not only by residents of Florida's Gulf Coast, but in many other parts of the world where somewhat similar micro-organisms periodically devastate marine life.

Not all water coloration is harmful, but it generally indicates that certain bits of living matter have multiplied so fast as to throw Nature out of balance. The coloring agents may be bacteria, diatoms, algae, flagellates or crustacea, and, de- (Continued on page 162)

March Misunderstandings

By GILEAN DOUGLAS

MARCH was well named after the god of war. All its thirty-one days are a struggle between warmth and cold, rain and snow, hail and rain, fog and sun. Sometimes the rain starts as ice pellets ten miles up, and sometimes it comes in soft mist from low-lying clouds. If you want to find out whether the rain brings the big drops of faraway or the small drops from mountain height, catch them on a plate of flour, or dry plaster of paris, and cast them as you would animal tracks.

And this *is* another month of paw prints. While the snow still covers the ground here in British Columbia, I find them everywhere; especially the tracks of my entertaining neighbors, the black bears. These are not rollicking tracks, as in summer, but a bit light and wobbly from hibernation. Going to a marshy spot for yellow arum one March morning, I found a thin mother bear and her two cubs there before me. Each baby was about the size of two of mother's paws and not yet weaned. They were getting a lesson in digging up the peppery shoots of my private patch, but I had no heart to shoo them off. It was just as well, perhaps, for mama had a sour glint in her eye that did not encourage anyone to interfere with her first meal of the year. She had a guarded look, too, and kept lifting her head to sniff the air for male bear scent. Male bears have a dangerous dislike of cubs in the spring, and her offspring must be protected.

PHOTOGRAPH BY LEONARD FRANK

The mother bear woofed her offspring up the tree, and then woofed him back down again.

My human scent disturbed her for only a few moments. First she woofed a command to her cubs to climb a tree, and then she woofed them back again. I can distinguish four bear noises, but better naturalists than I know more than twice that number. When commands are not obeyed the cubs are cuffed and sometimes a great maternal paw sends one rolling into the underbrush, or down a hill. But this time they all went on digging up yellow arum roots, and I found another patch nearby where I could cut the tender fresh stalks for salad greens.

In the ancient days, so the tales go, there were no salmon, and the Indians of the coast country lived on leaves and roots, particularly those of the yellow arum, which some people *will* call skunk cabbage. They baked them in pits with inner hemlock bark and the smell was wonderful. Then, as the spring salmon came for the first time, a voice shouted to them from the bank: "Here come our relatives whose bodies are full of eggs! If it had not been for me all our people would have starved." "Who calls?" asked the salmon. "Your Uncle Skunk Cabbage," came the reply. Then the salmon went ashore to reward him for feeding the people by giving him an elk-skin blanket and a war club, which he has to this day.

Actually the elk blanket looks more like a golden cloak (*Lysichitum*, the arum's Latin generic name, means "loosened mantle"), and the green war club is of flowers. These come before the leaves and smell heavily sweet, but by no means skunkish. Only when the plant is old does a hint of that appear. The thickly-clustered leaves — I have seen them four feet long and

more than a foot wide — make you dream of the tropics, and when these plants spill along the banks of streams they make living sunshine.

But if the yellow arum is misunderstood, the bear is more so. Prehistoric man, armed only with a club or stone, may have had reason to fear him, and the Indian with his bow and arrow was perhaps wise to step aside when he met a grizzly on the trail. But really they are mostly solitary, playful, friendly animals whose tendency is to run rather than fight. Of course if you scare them, corner them or wound them it is a different matter. How do you feel yourself when someone does such things to you?

Up around the Alaskan glaciers the black bear is blue, in the West he may be cinnamon, and pure white black bears have been found on certain islands of British Columbia's inland passage. Where I live he is a rather sooty-looking brown and very playful. He rolls through the woods like a drunken sailor and uses his claws as combs to strip the salmonberry patches before I have time to get to them. Occasionally we pick on different sides of the same bush, eyeing each other warily. Every now and then I come across a fat, furry form taking swimming exercises, or "cooning" up a tree. It is quite a sight to see the plump rear end backing down again. Or he may be turning over rotten logs in search of ant eggs. Blackie delights in mice, ground squirrels and chipmunks, insects and grubs — but his "kitchen love" is not reciprocated.

The black bear can become fond of humans, too. I have known half a dozen couples who were adopted by black bears, much to their annoyance. They never knew when a friendly slap or a playful pat might break an arm, a shoulder or a back. They could never tell when four hundred pounds of black furriness, with little eyes and a long snout, might smash their doors down when coming to call. As for food, there was no safe place they could hide it; especially if it was sweet.

One tourist couple were picked up by a bear at their camping place and changed it only to find the bear — or *a* bear, anyway — waiting for them at their next one. They sneaked away in their canoe one dark night and the bear swam right after them, swamping the canoe when he tried to climb on board. This was in northern Ontario, but two British Columbia hunters were almost drowned, also, when a swimming bear wanted to get into their rowboat with them. They were out after deer and did not want to shoot anything else, but finally had to put a bullet through their unexpected company when repeated blows with an oar failed.

There is a tree not far from my house where bears leave their messages for each other. I have seen a bear come up to this tree, circle it while seeming to examine every mark and then, rising on his hind legs, put his front paws around it and leave his own tooth and claw signs. Being intelligent and alert, Blackie can probably tell the size, sex, age and character of his predecessors. I noticed that the latest news seems to be the highest up the tree, and once I left my own scratchings at the top of the column. I wonder what the next bear made of them.

Coming back from town one night in late March, I rested my pack against what I thought was a boulder until it woofed and went away from there. So I found a real rock and sat down again to watch the black velvet of night change to the gray chiffon of dawn and finally to the gold brocade of full sunlight. The scent of wet earth and conifer needles was in my nostrils and there was a breeze blowing down from the high places that had the scent of hyacinth in it. But it was not hyacinth, it was wet bracken and one can smell it most strongly at the beginning and end of winter.

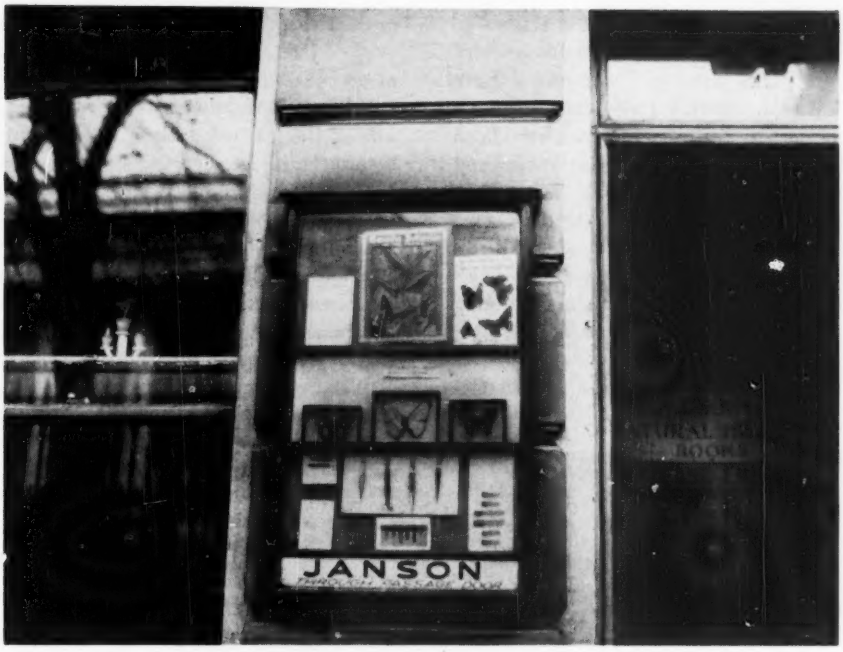
As I walked on again I knew that spring had really come, and that tomorrow I would see her wings of tortoise butterflies, and hear her ever-welcome cry as the Canada geese flew over.

Rockefeller Center Trees

By EDWARD McNAMEE

To soften harsh rigidity of line
Where shining masonry cleaves upper air,
The landscape-men effected fast repair
By planting young elms in a lush design.
Then with the aid of God's rain and sunshine,
Abetted by expert surveillance there,
And methods of the most advanced tree-care —
The elms quite promptly went into decline.

Now there are trees grown on a rock terrain,
That fight for life like wild and cornered cats,
That never get enough sunlight and air.
Ignored by man, ignored by needed rain,
Yet do not die — as these aristocrats.
Could it be that all trees resent much care?



The outside of Janson's shop as it appears today. The shop formerly occupied the front of the building, but has since moved to quarters in the rear. The facade of the British Museum, across the street, is seen reflected in the window at the left.

A Naturalist's Tradition

By NICHOLAS KING

GREAT Russell Street in London lies along the southern edge of Bloomsbury and is the address of the British Museum. It starts at Tottenham Court Road, under the ornate sills of the Y.M.C.A., and continues past residential hotels, expensive boarding houses, and the reserved show windows of publishers. But across from the Museum's solemn, tranquil facade it has preserved — much as reflected sunlight on other windows seems to keep a geranium alive on an areaway ledge — a row of shops and offices devoted, like museums themselves, to the leisure of collection and study.

Shut off from the noise of New Oxford Street behind, the heavy-lidded shops face the serene gravel and green of the Museum courtyard like cloister cells. Most sheltered of all is a shop that does not even have a window on the street, but is marked only by a glass case hung on the wall outside a door, and containing three mounted butterflies, a pair of forceps and a pamphlet on entomology for the intermediate student. A sign directs the way to Janson's.

Yet this shop, and the family which has owned it for a hundred years, is a relic of the ardent spirit of nineteenth century natural history; the solemn and purer side of the Victorians' passionate exoticism, theatrically preserved; once a haunt of Charles R. Darwin, Henry Walter Bates, and Alfred Russel Wallace, the great English triumvirate of natural discovery. And from this shop went out specimens all over the world, to Boston and St. Petersburg, many of them type-specimens — the ones from which species heretofore unknown were first described — and which formed the basis of the vast, methodical collections that are a commonplace in the museums of today.

The door creaked open into a musty passage; the click of typewriters came through the thin walls of the old building, and in the rear a second door among several others was lettered "Janson," and below: "Open Monday, Wednesday and Friday." It was like a film search for one great, secret source. Inside that second door, in a small room dim with the blue light of an alleyway afternoon and the smoky orange glow of a coal grate, a short, elderly figure bent over a table of books. Around the table were piled cases and packages, and on shelves along the walls from floor to ceiling stood more books, leather or cloth bound, thick or thin, seemingly never of ordinary size. Janson turned, still bent over, and straightened slowly, gray-haired, half bald, dressed with a carelessness overlaid on neatness, and wearing steel-rimmed spectacles on his pointed nose.

"Good afternoon," he drawled, in an old-fashioned London voice, turning on a green-shaded lamp that

swung from the ceiling, and taking off his glasses to peer at me through the gloom. Although curiosity itself would have led me to his shop, I was glad to have a sounder errand. Years ago my father had bought a mounted butterfly here; the case had recently been broken and he had charged me with having it repaired when I came abroad.

Janson said he could do it, but it would take some time, perhaps three weeks, he was so busy. "There's so few that can do real scien-tif-ic work, y'see."

At that moment the door opened quietly and a young man let himself into the room like a conspirator. He spoke with a foreign accent.

"Have you, possibly, anything on the Indian elephant?" he asked.

R. B. Janson and his father, Oliver Janson, outside their shop about 1906. It is the same doorway that appears in the picture of the shop as it is today. The Simplified Speling Sosieti does not seem to have achieved its ends with the passage of the years.

Janson put his glasses back on and looked slowly upward over his shelves.

"No, no, nothing at all, except maybe for reports of scientific societies," he replied at length. He was not very interested in the mammalia.

Janson's firm was started in 1852 by his grandfather, Edward Wesley Janson, as a small center for scientific books and certain kinds of specimens, mostly insects, but including birds and plants, which he sold to museums and to the legion of private collectors that sprang, full-armed and thirsty, from the complacent Victorian countryside. In those days, the interest in Nature, particularly exotic Nature, was as intense as the interest in material progress, and even spilled over into popular culture in the schoolboy's collection of eggs and the stuffed bird under the parlor bellglass.

In 1852 Bates was pushing his way slowly up the Amazon, finding as many as 550 new species of insects in one spot, and sending his collections back to England. Darwin's account of his voyage around the world in the *Beagle* had been out for 12 years, and in the same year of 1852, Wallace, returning from Brazil, lost most of his collections and notes when his ship burned at sea. John James Audubon, who had captivated if not convinced the learned authorities of Europe twenty years before, had just died in honored old age at Minnie's Land. And Humboldt, whose vast history of his voyages on the Amazon and Orinoco was the century's first authentic inspiration for scientific discovery, was feebly finishing his "Kosmos" in Berlin. The museums, like the scientists themselves, were intoxicated by the discovery and classification of the earth. The eighteenth Century had been satisfied to inspect the strangenesses of Nature — including men — found in unknown regions; now conclusions had to be drawn in science, and for science, data were needed before reason or logic could operate.

The western world had depended in the past for its information of undiscovered fauna and flora, especially in the western hemisphere, on specimens brought back as curios by sea captains, military surgeons and missionaries. Now trained scientific collectors were sent into the field to collect examples of the life they found, most of which was unknown, or at least unclassified. Today this is done by large museums exclusively, but then collectors either had enough money to make the expeditions themselves or else did the work on commission.

The first Janson established a world-wide system of collectors, concentrated in the two regions of teeming life, tropical America and tropical Asia. Bates himself sent many specimens to the shop in Great Russell Street, and Janson's son, Edward M. Janson, half-collector, half-mining engineer, died in Nicaragua at the age of 33. Some discoveries were named for the Jansons themselves — the butterfly *Anea jansoni* from Nicaragua, and the beetle *Phosforus jansoni* of Sierra Leone. The first Janson was an expert in British coleoptera.

This system, which continues today on a curtailed basis — particularly in the Orient, where the tropics are no longer remote or peaceful — was not necessarily profitable. Janson advanced money to collectors to spend a year in the Amazon basin, for instance, and they would then return with a collection from which the sponsor reserved the best items and sold the rest to hungry museums. But often the collector was stricken by fever; or he lost all his work in a shipwreck; or else he was not well enough trained to handle successfully his fragile captives. For if a scientific speci-

men is incomplete or damaged, it is worthless.

"It's all this civil-i-zation, as they call it, that's clearing away all those fine things out there," Janson said. He was referring to the East Indies where some of the most spectacular butterflies are found — the giant ornithoptera, the bird wings, that a startled Linnaeus called *Papilionum omnium princeps augustissimus*.

He pulled down what appeared to be two tall, leather-bound volumes, but which opened like a backgammon board and contained, quivering inside its white interior, giant golden bats, each measuring seven or eight inches across the wings, the rare green-yellow and black *Ornithoptera chimera*. The *chimera* was discovered by another great nineteenth century British naturalist, A. S. Meek, who also collected regularly for the Jansons, on the southern slopes of the Owen Stanley range in New Guinea, where many of the specimens extant were taken fluttering on a single flowering tree. Meek also discovered what is generally agreed to be the largest of all butterflies, the *Ornithoptera alexandriae*, and captured his first one with a shotgun.

Several of the butterflies in Janson's collection are so scarce he will only part with them to a major museum. He even refuses to name the exact region they come from, or who collects them for him, for fear a troop of interlopers might descend into those remote valleys and exterminate them. Janson is worried, too, about the more common *Ornithoptera croesus*, the insect whose great, fire-orange wings forced open in the net made Wallace almost faint with excitement. The *croesus* is now confined to the island of Bachan in the Moluccas. Many other species, including the purple and black *Urvilliana* of the Solomons, have decreased sharply in numbers as a result of the Pacific campaigns of World War II.

Even in England there have been casualties. When the fenlands in southern England were cleared in the last century, for example, the shimmering British large copper butterfly went with them. A copper was subsequently successfully introduced from the Continent. "No sheen to it though," Janson complained. "It took centuries of generations for ours to get those wings. You can't expect this new one to be like it." And Janson's own specimens of this butterfly are as bright and perfect as when they last flew over English meadows, more than 110 years ago.

He opened a thick volume of John White's voyage to New South Wales in 1790, one of the first attempts to record and classify the natural life of a new continent. The faded old plates, drawn by White himself, were labelled with Latin names of his own approximation. Occasionally these names bore pencilled corrections made by the first Janson.

"The white-jointed spider," Janson said meditatively, looking at a delicate drawing. Then he shook his head. "They're cutting down all the trees out there and that's going too."

All the dealings of the firm are recorded in thick, red-leather-bound books in a fine copper-plate hand that succeeding Jansons have been able to master. Darwin's name appears often. In May, 1868, for instance, he paid eleven shillings cash for "insects." He was such a frequent visitor to the shop that there was a chair specially reserved for him and known as "Darwin's chair," now an ornament to Janson's home in north London.

Great Russell Street as it is today. Janson's shop is reached through the doorway at the extreme right, next to his wall-case of butterflies.

In 1870, according to another entry, the British Museum paid five pounds for a manatee collected by Bates many years before on the Amazon. In 1884 a collection of twenty Malayan birds went to the Musee d'Histoire Naturelle in Paris, and in the same year Harvard University paid thirty pounds for a group of plants from the Straits Settlements. It is no surprise to find frequent mention of the Entomologische Verein of Berlin.

Janson's firm had dealings, as well, with the Imperial Academy of Science at St. Petersburg, but they did not always turn out well.

"My father sent them a collection of type beetles once," he said, "and later a famous Russian naturalist — I forget his name, but there's a street named after him in Paris — came to see him and told him the beetles had not received any proper care and they were in a pit-i-able state. Oh, my father was most upset about it."

Private collectors flourished in the latter half of the nineteenth century. Like the sinister Stapleton, they bounded over the English moors with butterfly nets, or scaled the Matterhorn in search of alpine flowers. Cases and albums held respected places in the array of Victorian household gods. Museums, which until then knew the curiosity-seeker rather than the student, and displayed giraffes and camels as "wonders" in the manner of Barnum, wanted accurate and complete collections of everything that lived, or had lived, under the sun. And so natural history passed from a quizzical interest in the peculiar to a breathless ardor for the exotic.

Janson's father, Oliver, who died in 1926, believed fervently in the pure motives of the scientific collector, and was extremely wary of selling specimens for commercial decoration or individual adornment. He was scrupulously careful of the skins of birds whose feathers were sought for women's hats. Even today his son has a cigarbox of hummingbirds he will not show the ordinary customer — he will not even say how they were killed — and is still made indignant by letters he receives from business houses which ask to buy Morpho butterflies for their opalescent blue wings. So he sets out on a shelf only one or two mounted specimens, magnificently mounted, too, with glass on both sides so one may see the rich and varying undersides of moths and butterflies that never show in museums, as a sop to the passing, charmed eye that sees them.

One of his greatest treasures is a set of books, published by his grandfather, recording the discoveries made during the voyage of the *Erebus* and *Terror* to the Antarctic from 1839 to 1843. For among the lithographic plates, delicately colored by his daughter, the aunt of the present Janson, is the only trace of an extinct New Zealand bird, a large, short-billed rail, *Rallus dieffenbachi*. The only known skin of this rail was destroyed many years ago in a fire in New Zealand. Janson planned a subsequent work on a journey made to Northern Canada in the late 18-forties under Sir John Franklin, but he and his expedition were lost in the ice.

Janson still has a few copies of the work (there were originally only several hundred) and doles them out after lengthy consideration on what might be called a merit basis. For instance, he recently "let one go to correct quarters in Canada."

Janson himself has never traveled, but he has been content to know the world through those Alladin treasures whose gradual disappearance saddens and angers him. He laments the regimentation of modern life in so far as it affects — and it affects seriously — the flourishing of Nature, and feels, rather like the old-

Edward Wesley Janson, founder of the firm in 1852, with headquarters at the same place as today.

fashioned missionary, that only man is vile, that people ignore the blessings they could count around them in the natural world. "Nobody knows anything anymore," he observed bleakly. "I have one or two important government people coming in here — why, they don't know much about science; and yet here they are supposed to solve problems of agriculture and population!"

Collectors have much declined in numbers and attention, and so have those establishments that served them, but museums have not, and now with the study by governments of Nature as an economic agent, Janson has more commissions and orders than he can comfortably handle. Luckily, he has a son, Derek, a Royal Air Force veteran married last year, who relieves his father of much of the burden, and whose fine handwriting now takes its place in the record books below that of his forebears. Derek started entomological work at the age of five under the tutelage of his father and grandfather, and has turned out to be as skilled a craftsman as any of them at the infinitely precise and laborious task of mounting specimens.

The Jansons know where most of the rare insect specimens are in England, as an art-dealer knows in what collections or galleries hang the works of Rembrandt or Goya. Once someone came to their shop with a certain rare moth to sell. They became suspicious, since they knew just where this moth was to be found in British collections, and asked to keep it for verification. The would-be seller hastily withdrew.

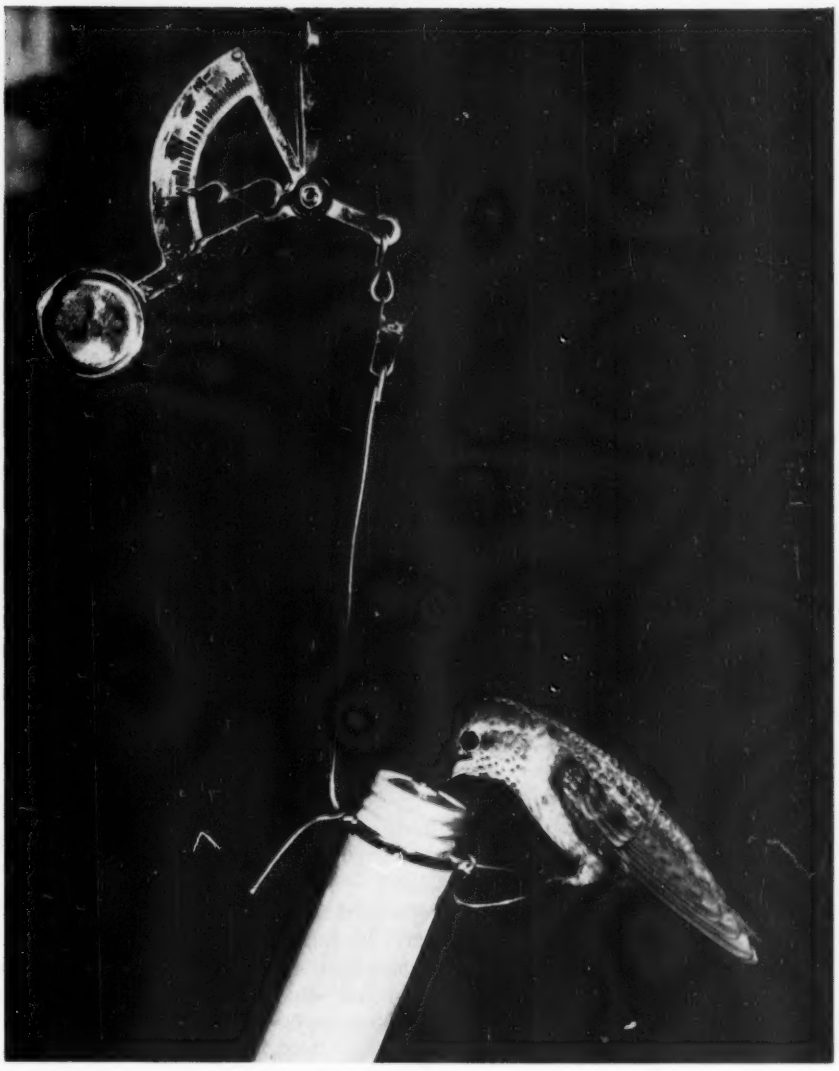
At this moment the Jansons are upset and worried by an aspect of the London County Council's plan for post-war London that (Continued on page 162)

Sugar for that Slim Girlish Figure

By WALKER VAN RIPER

Denver Museum of Natural History

Photographs by the author with high-speed electric flash developed by Dr. Harold E. Edgerton and associates at M.I.T.



This broad-tailed hummingbird learned how to reach the syrup in the feeding vial, and was a regular customer, and the only one. Thus it was possible to measure her weight, day by day, and to measure the amount of fuel she took on. She averaged about twice her weight daily of the syrup alone, and took on fuel at the rate of about 34 times the requirement of a reasonably active, 150-pound man.

MY PET tarantula, "Leidy," weighs eighteen grams, or about six-tenths of an ounce. She is in perfect health, having just passed the test of her annual molt. In the more than three years that she has spent in my care I doubt that she has consumed half her weight in the meal worms and beetles I occasionally feed her. In fact, there are numerous records of spiders and insects living for more than a year without either food or water. Leidy is a gentle and inactive creature and requires a minimum of fuel to keep her sluggish engine turning over. Moreover, as she is a cold-blooded animal, she needs no additional fuel to regulate her body temperature.

The fuel requirements of animals vary, like those of a machine, according to the amount of work being done. With warm-blooded animals there is the additional need for energy to maintain body heat. This last requirement also varies inversely with size, that is, the smaller the animal, the greater its need relative to weight. Hence it is to be expected that an intensely active, warm-blooded and also small animal, like a hummingbird, will have a high energy requirement. The doctors would call it a high metabolic rate.

Dr. O. P. Pearson at the University of California has studied and measured the metabolic rates of a number of small mammals and birds. He has found the hummingbird to have the highest rate of any animal yet measured. Anyone who has had a basic metabolism test knows it is based on oxygen consumption and taken when fuel supply is low. Metabolic rate at other times relates to oxygen use and is always proportional to food or fuel utilized.

In August, 1951, I wrote in *Nature Magazine* about the ways and means of attracting hummingbirds to the garden. About the time this article appeared my own hummingbird feeders were overrun with honey bees to an extent never experienced before. So I began to experiment with various bee excluders, and finally ended up by excluding both bees and hummingbirds, with the exception of a single broad-tailed female. She

"Leidy," the tarantula, weighed about six-tenths of an ounce, and the author doubts that in the three years she was his pet she consumed half of her weight in meal worms and beetles supplied.

had learned to come to a single half-ounce vial that had a hole one-eighth inch in diameter in its aluminum cap. This was large enough for the hummingbird bill but too small for bees and wasps. The bottle was fastened to a stake in the garden, and I put a wire perch on the neck of the bottle so that the bird might come to rest when she fed.

When my hummer had learned to do this, and when I was satisfied that I had only one customer, I had a good chance to measure how much syrup she consumed per day. So I hung the bottle on a postal scale and made a record, morning and night. There was opportunity, also, to measure the weight of the bird, and this I did by photographing her at rest on the perch. I made a series of such pictures, and this made it possible to average the weights and also to make certain that I was dealing with the same bird. She could be identified by a group of spots near the eye.

An average of seven weighings fixed her weight at 4.3 grams. A dime weighs 2.5 grams; a penny, 3.1 grams; a nickel, 4.9 grams. Four and three-tenths grams is a little less than one-sixth of an ounce. So you could send half a dozen of these birds, by first-class mail, for one three-cent stamp!

Our more familiar hummingbirds, the ruby-throat of the East, the rufous and broad-tailed of the Rocky Mountains, and Anna's, the commonest of the California birds, all look to be about the same size. But the few records we have show considerable variations in weight, not only as between species, but for individuals of the same species as well. Thus, in the literature, I have found ruby-throat weights from 2.9 to 3.5 grams. Dr. Pearson used five Annas and two Allens in his metabolism experiment. A male Anna weighed 4.3 grams; a female, 3.8 grams; and two Allens, male and female, 3.5 grams. A rufous, caught in a banding trap, weighed 2.9 grams, and a black-chinned was recorded at 2.6 grams. The smallest hummingbird coming into the United States is the calliope. I find no record of a weighing, but this bird is definitely smaller than the black-chinned and probably weighs not over 2.5 grams, the weight of a dime. The English sparrow has been recorded at 25.6 grams, and a chickadee at 9.8 grams.

At 4.3 grams our bird was apparently on the heavy side, and this was probably related to the fact that, within a few days, she was to take off on the long migration south to winter quarters in Central America or southern Mexico. There have been a number of observations that indicate that birds about to migrate accumulate fat, and I have twice noticed my hummers feeding especially heavily a day or two before departure.

The syrup I use to feed my birds is 22 percent, by weight, granulated white sugar dissolved in tap water. The broad-tailed hummer took, on six different days, from 7.1 grams to 10.6 grams of syrup, for an average of 8.3 grams. Thus she averaged nearly twice her own weight of syrup and 42 percent of her weight in pure sugar. In addition to this she was seen visiting flowers in the garden and hawking insects in the air.

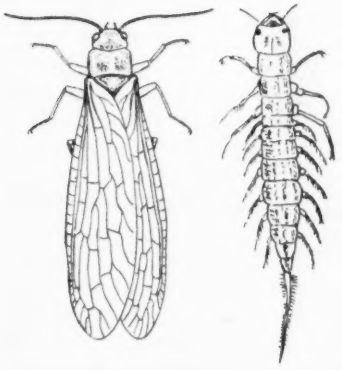
There have been a few other observations on hummingbird appetite. Dr. H. O. Wagner, the Mexican naturalist, who has accompanied shipments of live hummingbirds to European zoological gardens on several occasions, reports that it is not unusual for a hummingbird in captivity to take twice its weight in syrup per day. Prof. Frank Bené, in the course of his extensive observations on the feeding habits of the black-chinned hummingbird, measured the amount of honey consumed by a single bird at one-half teaspoon in one day. He reduced this to calories per gram of bird in order to make an interesting comparison with the human energy requirement. (Continued on page 162)

Some More Water Insects

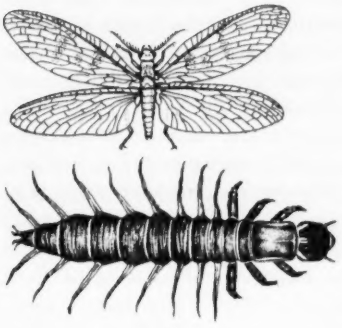
By E. LAURENCE PALMER

Illustrations by the author, Ellen Edmonson, and Velma Knox.

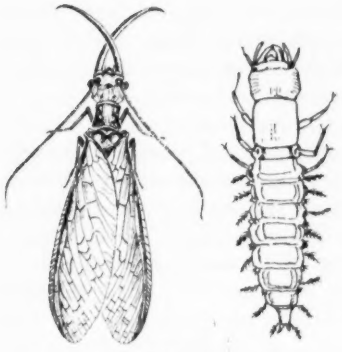
This is the seventieth in NATURE MAGAZINE'S *series of educational inserts.*



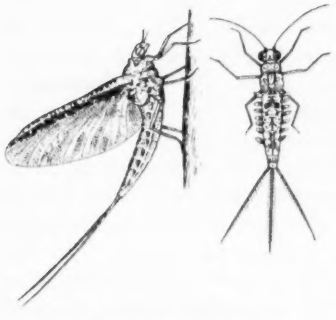
ALDER FLY



FISH FLY



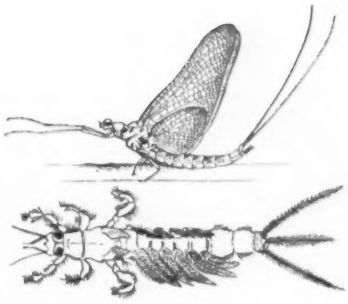
DOBSON FLY



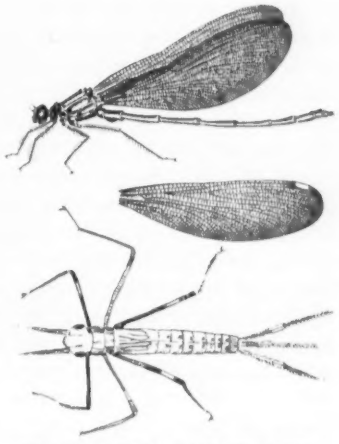
PALE GREEN MAYFLY

Do you like to shiver because of superstitions, to gloat over the possession of good fish bait, to read good Nature prose and even better Nature poetry? Do you like the comics? I like all of these things. I admit that some superstitions affect me more than others, that some bait is better than other kinds, that poetry and prose vary in their merits, and we might not agree at all on the comics. However, it is my choice of comics that led me to write this particular insert at this time.

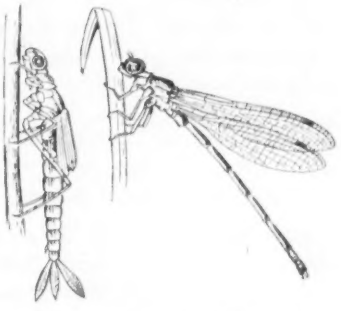
I must be getting old, since few of my associates remember Billy Bounce, who amused me as a youngster, Petey Dink and a few others of those days. As a substitute for these fairy tales, and without losing interest in real fairy tales, I have in recent years got my fun from reading courses of study and textbooks for pre-college years written by persons who could not possibly have fished, rambled, photographed and enjoyed the kinds of things I assume are shared by readers of *Nature Magazine*. Just recently I have been reading a couple of new books that I have enjoyed thoroughly. In one of these, we see matching pictures of may flies and dragonflies. Beneath is the legend that tells us that the "larvae" of these insects feed on mosquito wrigglers and other forms of life, and the adults catch smaller insects as they dart back and forth in the air. It is because many youngsters will be exposed to this sort of statement that I elected this month to help you to know may flies and dragonflies and their associates better. Any experienced entomologist would have gagged at the assumption that adult may flies eat anything ordinarily, and would have questioned the implication about the food habits of the nymphs or younger stages of the may flies. May flies and dragonflies hold too prominent a place in my thinking and experience to let a statement like this one go unchallenged.



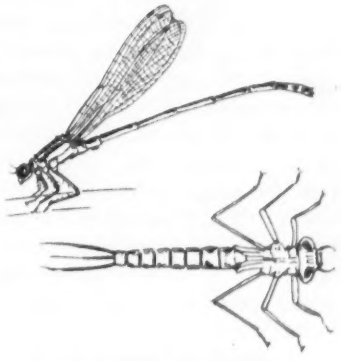
EEL FLY



BLACKWINGS DAMSEL FLY



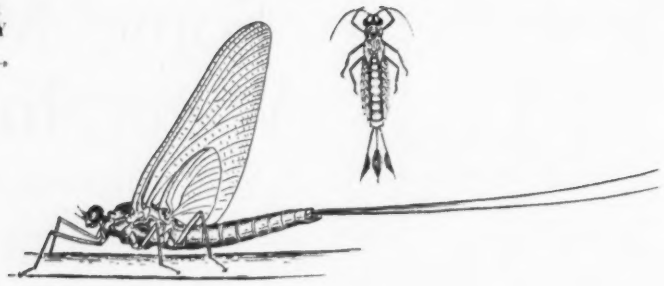
CHROMAGRION DAMSEL FLY



FORKTAIL DAMSEL FLY

RUBY-SPOT
DAMSEL FLY

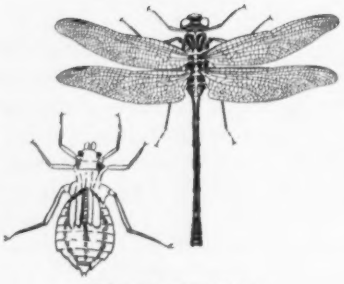
SPRING
MAYFLY



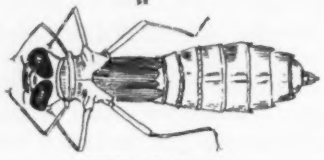
Have you watched a flight of may flies, seen a courting pair of dragonflies, or a hunting green darner? Have you watched dragonflies mate or lay eggs? Have you been frightened by dobson flies under a light or hellgrammites under a stone? Have you fished upstream when stone flies were emerging downstream? Have you read Benjamin Franklin's "To an Ephemera," or Tennyson's "The Two Voices?" True, Franklin missed the point, but I know of no prose writer who matches Tennyson's description of an emerging dragonfly;

"Today I saw the dragon-fly
Come from the wells where he did lie.
An inner impulse rent the veil
Of his old husk: from head to tail
Came out clear plates of sapphire mail.
He dried his wings: like gauze they grew
Thro' crofts and pastures wet with dew
A living flash of light he flew."

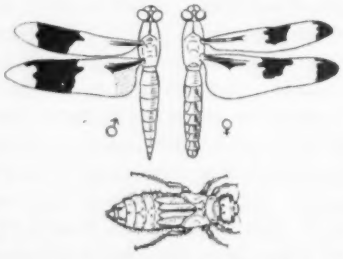
Some of our educators see no place for verse in a science course. Similarly I see no place for much of the prose they give us in a course of any sort. I make mistakes, plenty of them, some in these inserts, but I doubt if I can ever match some of the textbook authors who write for children. An introduction my third grade teacher gave me to Tennyson is something I wish other youngsters could get, even at the sacrifice of some of the "science" that is offered them. Had the writers of the particular text to which I have referred read the first of these inserts I would not have been stimulated by them to write this one. While the table showing insect orders in this book lists the group to which the dragonfly and damsel fly belong, it makes no mention in the table of the may fly or the other insects I featured in the first insert, and elaborate here.



BLACK DRAGON



GREEN DARNER



WHITE-TAIL DRAGON FLY

TEN-SPOT DRAGONFLY
(Described in insert #1)

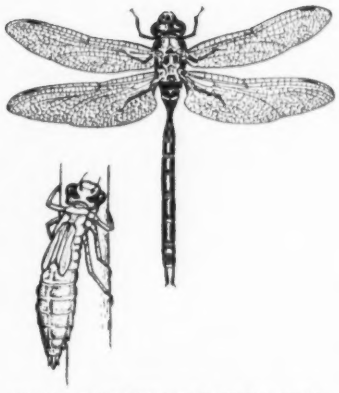
At the risk of losing some of my audience I must begin this story with the statement that the insects here considered belong to four orders. The Neuroptera include the fish flies, orl flies and dobson flies. The Ephemerida include the may flies. The Odonata include the damsel flies and dragonflies. The Plecoptera include the stone flies. I doubt if there is any reader who has ever been out in Nature much who has not at some time seen some of these creatures. Even in the largest cities may flies may sometimes be so abundant that they are swept up and carried off by the cartload. I have seen them darken the skies and street lights in the East and middle West, and I have watched some of these insects beside a wilderness trout brook.

Within the group to which the fish flies, alder flies and dobson flies belong, we have such common and better known insects as the ant lions, whose larvae are sometimes called "doodle-bugs," and the highly useful golden-eyes, lacewings, or green flies. Some members of all of these groups are known in some way by most persons. The doodle-bug interests many youngsters. May flies fooled Ben Franklin, and while the adults rarely live over two days that does not constitute the complete life cycle, as Franklin implied in his delightful letter "To an Ephemera." Dragonflies of course rate high in the realm of superstition, doctoring snakes, sewing up noses and ears for the Devil, and generally making trouble. I doubt if there is anywhere a more interesting group of insects for the naturalist. The stone flies are ordinarily so self-effacing that they are not well known, but some swarm conspicuously over our early

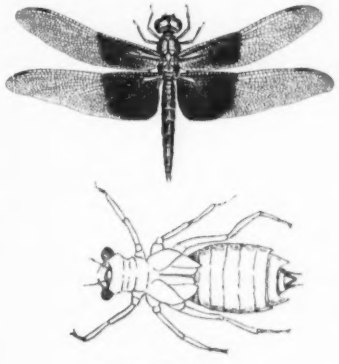
spring snows, and a few may be considered as pests of fruit trees in some parts of the country.

Food Habits. The insects of these groups have decidedly varied food habits. Roughly speaking, however, the adults considered are not plant-eaters. Either they eat nothing, as is usually the case with the adult fish flies, dobson flies, may flies and stone flies, or they feed on other insects, as with the damsel flies and dragonflies. Despite what the high school biology to which I referred says, may flies do not dart about catching small insects. If they eat at all it is the exception.

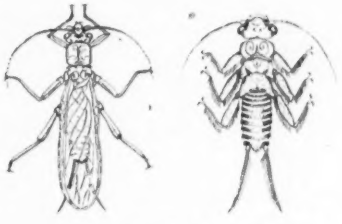
Studies have been made of the food habits of adult dragonflies, and these show that they feed on other insects. They eat friends as well as foes of our agricultural products in about equal proportions. Taking dragonflies as a group, we find some most interesting food habits. Some, like the darners, of which we here present some examples, are strong, high fliers. Others, like the ten-spot, featured in the first insert, range around 15 feet above the ground. Neither the widow nor the white tail are high fliers. The damsel flies usually range lower than the more powerful dragonflies. Just as we apparently find that the different dragonflies seem to assume responsibility for different elevations, so we find that some stay close to a waterway, where they may lay their eggs, while others, like the powerful darners, can roam safely a mile or more from such a site. Then, too, there is a responsibility of season that seems to have been established. Some range only at dusk or dawn, others only in strong sunlight. Still others roam about from earliest dawn to close to darkness. Some are early season dragonflies while others do not appear until fall, and some are active throughout the summer, spring and fall seasons where there is suitable open water.



BLUE DARNER DRAGON FLY



THE WIDOW



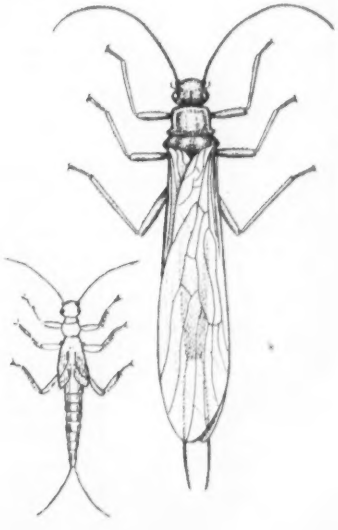
THE STONE FLY *(Perla)*
(Described in insert #1)

Except for a few of the stone flies, none of the insect groups here presented can be considered as insect pests of agricultural importance.

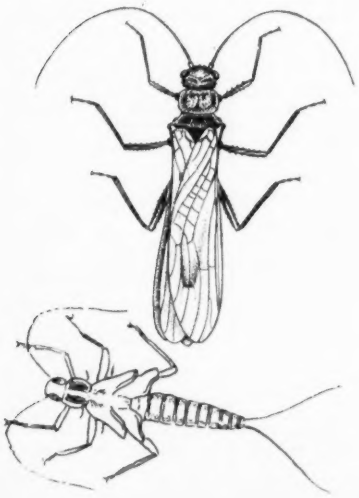
When we consider the food habits of the immature insects of these groups we have still further fun. The details of most of these are presented in the chart section, but I must emphasize that, for the most part, the immature may flies are out and out plant-eaters, while the immature stages of the other groups are largely animal eaters although many stone fly nymphs are plant-eaters. Certainly immature may flies do not feed to any extent on mosquito wrigglers. If you think they do, confine some in a tumbler aquarium and let me know the results. Essentially these may flies in their immature stages are the creatures that convert plant material into animal food that may be eaten by more powerful animal-eaters. They are to dragonfly nymphs, to dobson fly larvae, stone fly nymphs, and to many fishes, what cows are to us.

How These Insects Move. The adults of all of these insects fly. Flight however is a vari- (Continued on page 144)

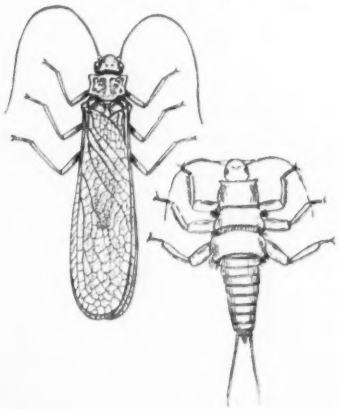
EARLY SPRING STONE FLY



WINTER STONE FLY



LATE SPRING STONE FLY



NAME SCIENTIFIC NAME	ALDER FLY, SMOKY ALDER FLY, HUMP-BACK, ORL FLY *Sialis infumata*	FISH FLY *Chauliodes pectinicornis*	DOBSON FLY HELLGRAMITE *Corydalis cornuta*	PALE GREEN MAY FLY *Callibaetis skokiana*
DESCRIPTION	Wing expanse 1 to 1-3/5 inches. Males somewhat smaller than females and hindwings shorter than forewings. Antennae about equal to body length. Body and wings black to rusty black. Adults probably live less than 3 days; prefer sunshine; do not eat; fly awkwardly. Harmless.	Length to wing tips over 2 inches. Wing-spread to nearly 4 inches. Female larger than male. Forewings gray with transverse yellowish streaks. Hindwings grayish. Hind part of head with yellowish flat streaks and spots. General color, cinnamon. Head wide. Antennae coarse.	Wing-spread to over 5 inches. Length to wing-tip about 3 inches. Sizes of sexes vary. Male with long, clasping jaws. Female with smaller, apparently more normal, jaws. Cinnamon brown bodies. Wings gray-white and spotted with little whitish dots. Head spotted and streaked with yellow. Legs brownish.	Total length of adult about 1 inch, with wing-spread of 4/5-inch. Pale flesh color marked and dotted with brown. Antennae and legs white. Male with 2 "tails" to 4/5-inch long. Female more yellowish with 2 "tails" to about 3/5-inch long. Subimago smoky brown with yellow on middle of fore-margin of front wings.
RANGE AND RELATIONSHIP	Found in adult stage near clear streams and lakes, usually active in daytime. Larvae burrow in bottom muds, sands or gravels of streams to depth of 1 foot. Pupae found buried under several inches of earth, sometimes some yards from the water's edge. Eggs laid at water's edge under protection. Family Sialidae. Order Nevroptera.	Found in and near fresh waters from New England to Florida and west to Michigan, Missouri and Louisiana, with related species extending the range. Considered with the orl flies and dobson flies as members of the Order Neuroptera, with all other members of the Family Sialidae. Nine species.	Family Sialidae. Order Neuroptera. Found often under street-lights where adults are attracted by light but usually not far from running water, whence they emerged. Quebec to Minnesota and to South Carolina, Missouri and Kansas. Adults do not fly well and are often found on ground.	Order Ephemerida. Family Ephemeridae. Ranges rather generally throughout North America. The genus is peculiar to the New World. Brown band on front of forewings more conspicuous in female is reasonable identification of adults. Adults seen floating on water with wings outspread while laying eggs.
REPRODUCTION AND JUVENILE STAGES	Adults emerge in spring, mate, lay eggs and, in a day or so, die. Eggs dark brown with white point, in clusters of some hundreds, hatch in about 10 days. Larvae as pictured grow to length of over 1 inch. Form pupal stage. Pupal stage lasts 2 or 3 weeks.	Adults appear about June, fly awkwardly, mate, lay eggs in masses of to 2000 over water. Eggs hatch in night, 5-6 days after being laid. Larvae live in water, probably over a year, or even 3 years, making a number of molts. Pupate some inches underground some feet from water. Pupal stage to 2 weeks.	Mate late spring or early summer and adults die in a day or so. Eggs laid in masses of to 3000 on supports, usually over running water; mass over 1 inch. Larvae live to 3 years in streams, reach to 3 inches, rough, dark brown, leathery looking, tufted gills. Pupate underground away from water 1 to 2 weeks.	Adults emerge through late spring and summer as subimagoes or duns that live for 1 day, inactively, then shed skins to form imago or skimmers that mate, lay eggs and die usually in another day. Nymphs develop in about 6 weeks to about ½-inch at maturity and emerge, with several generations in a season. Females shy.
ECOLOGY	Larvae feed on other animals such as caddis fly larvae or their own kind. Pupae of course do not feed and larvae stay in water until ready to pupate. Adults of *S. nevadensis* reported, possibly erroneously, to feed on grape leaves. Larvae and adults superior food and bait for fish.	Adults probably eat nothing and die in a few days. Larvae feed on all small animals they can overpower, can be fed house flies, caddis flies, spiders and even own kind. Themselves serve as excellent food for fishes.	Adults probably eat nothing. Larvae feed on variety of aquatic animals, hitch along backwards, may bite viciously and at slightest disturbance, flattened, with gill tufts at side of each of first 7 segments. May be kept in cool boxes with wet vegetation or for weeks in cool cellar or longer in running water.	Food of nymphs is essentially plant material and nymphs are found active and alert among waterweeds and even algae that would entangle many other water insects. Make excellent aquarium insects, since can survive conditions commonly fatal to many other may fly nymphs. Move with "howdy" up-down body bending.
ECONOMIC IMPORTANCE	Excellent fish food, but probably destroy many other insects of fishfood value, and so may not be efficient in food cycle. May possibly destroy fish eggs and young fishes. Can hardly be raised efficiently for use and sale as bait as can crayfish, crickets and similar animals.	In some places larvae have commercial value as food for fishes, being used as bait. In some States certain streams are closed to harvest of these larvae, leaving them available as food for the associated game fishes and as sources for maintaining bait supply in other streams.	New York bait-dealers in one year sold 366,816 hellgramites, or conniption bugs, or dobson fly larvae, at $8807.55 for use as superior bass bait, and some streams producing them are closed to collectors to prevent destruction. May destroy fish eggs and some young fish but on whole valuable as fish food.	Serve useful function as converters of plant material to food suitable for use by animal eaters. Particularly useful because of many broods that keep water well supplied with nymphs over a longer period than is common with many may flies. Subimagoes may be identified in part by delicate hairs on spotted wing margins.

Spring May Fly *Blasturus sp.*	Large May Fly Eel Fly *Hexagenia sp.*	Blackwings Damsel Fly *Calopteryx (Agrion) maculatum*	Ruby-spot Damsel Fly *Hetaerina americana*	Chromagrion Damsel Fly *Chromagrion conditum*
Adults (Dun) dull brownish-gray with body ruddy or brownish, with browner rings at abdomen joints. Tail filaments 3, with the middle one about half the length of the other two whose length is about ½ total length of extended insect. Forewings about 2/3 length of longer filaments, held erect. Live only day or so.	Large may fly, the adult of which characteristically rests with pair of forefeet extended free of contact with support. Forewings about twice length of hind wings and terminal appendages of abdomen about 1/3 total length of extended adult. Possibly the largest of the may flies.	Adults. Male a brilliant beautiful uniform metallic green or blue on body with distinctly and conspicuously black wings. In the female the front of each forewing near tip bears distinct white spot but otherwise the appearance is similar to male. Abdomen is slender and wings seem loosely attached.	Length to 2-2/3 inches. Wing-spread to 2-1/3 inches. Copper bronze and metallic green with brilliant ruby spot at wing bases in both sexes. Wings otherwise more or less clear. Female has amber yellow at wing base instead of ruby, with more yellow on sides of thorax. Legs blackish.	Adult, length 1-2/5 inches. Wing-spread, nearly 2 inches. Blue and yellow. Wings clear with long narrow spot near tip to the forewing. Legs blackish. Top of head black. Segments 6 and 7 of abdomen wholly black. In male segments 8 and 9 of abdomen with round spots on blue background above, with dividing blue line above. Legs rather long.
Order Ephemerida. Family Ephemeridae. Found in or near fresh water ponds or streams in adult forms in May or June and as eggs or nymphs remainder of year. Apparently has no counterpart in Europe and is essentially American. May migrate from open water to stream or quiet pools in life time.	Order Ephemerida. Family Ephemeridae. Ranges through most of North America with adults emerging through late spring and summer. Nymphs to 2 inches long found burrowing in mud in shallows of freshwater lakes, streams and bogs. They are more prone to be in slowly moving streams than in fast water.	Order Odonata. Family Agrionidae. Found usually close to ditches and streams that are small and near rocky woodlands, sometimes found along paths leading through woods to such streams. Flight is poor and so remain inactive except on good days suited to their needs. Season is April to September.	Order Odonata. Family Agrionidae. Ranges widely through North America generally, but commonly found in late summer season about streams and overhanging branches. Rarely found over a few yards from water's edge. May congregate in flocks of considerable size for a damsel fly. Males frequently rest on stones.	Order Odonata. Family Agrionidae. Known from Maine to New Jersey and west to Quebec and Indiana. Found for the most part on grasses and sedges near the edges of shallow pools, or as nymphs among vegetation in the pools. Not a ready flier and may stay for long periods of time resting on vegetation.
Eggs laid, probably in open water, develop into nymphs (brown quill of fisherman fly book) which reach length of nearly 1 inch boasting 3 equal "tails" and ruffle of gills along abdomen side, moving by "howdy" action bending body up and down; swim rapidly but may feign death if disturbed by removal from water.	Adults emerge in enormous numbers, swarm to lights, mate, lay eggs and die without eating after emergence. Accumulation of adults under lights near river towns may be 3 to 4 feet square and to 8 inches deep. There is no pupal or resting stage. Nymphs may mine way into mud banks but not for pupation purposes.	After mating the female, unattended by male, lays eggs in plant stems just below water surface. Nymphs showing whitish bands on legs and terminal filaments may reach length of 1 inch and may be found moving awkwardly in vegetation seeking other insects for food.	Adults appear about mid-July, mate, and female lays her eggs in soft plant material under water unattended by male. Nymphs live in moving water or rapids in shallows. Nymphs are brown or green without showy color pattern and reach length of 1¼ inches and move by sideways swinging of abdomen. Relatively slender. No pupa.	In late spring or early summer adults mate and lay eggs. The nymphs develop rather long narrow gills at end of abdomen but these taper sharply near the tips. After development among submerged vegetation, usually rather well away from shore, transformation takes place just above water in early morning or early afternoon.
Adults shed skins twice, the first stage being the subimago or dun stage, usually with dull wings and the second imagos or spinners with glistening wings. Adults do not feed, despite what some high school texts say. Nymphs essentially plant feeders serving to convert plants to suitable animal food.	Nymphs burrow rapidly into soft muds and oozes, feeding on algae and diatomaceous stuffs and converting these plant materials into animal food suitable for consumption by larger animals including the fishes that are valuable as game. The Green Drake, Spinner or Coffin Fly of rapid trout streams is almost as large.	Both adults and nymphs feed on insects captured in flight by adults and by stalking in water weeds by nymph. Nymphs move by crawling, by sideways flexing of body and by forward thrust. Like other aquatic nymphs and adults of the group these damsel flies may be useful destroyers of mosquitoes.	Adults and nymphs feed on other small forms of animal life. Males known to be attracted to pink color similar to that in wing bases. Males apparently not shy and are easily captured. Females and males may assemble in groups of hundreds, the grouping usually beginning in the afternoon and lasting until next day.	Both adults and nymphs feed on insects and other small animals found in their vicinity. Locomotion in the nymphs is by sideways flexing of body or by crawling or by jet propulsion caused by ejection of water through rear of abdomen as in other damsel flies. Jaws of nymph, as in other damsel flies, extend with hinge.
Serve great role of the world, converting plants to animal food for animal eaters. May appear in enormous numbers during emergence season. Read Benjamin Franklin's "To an Ephemera" in his Autobiography, even though Franklin was misinformed regarding total life history.	Economic importance has been suggested above, but in some resorts are considered as pests. A type of hay fever sometimes results from fine scales of wings of swarming caddis flies but we do not know if this is also the case with these large-brooded may flies. Since wings lack fine scales it is doubtful.	Serve dual role in controlling multiplication of aquatic insects, some of which are noxious, but also serve as food for other animals including some common game fishes that may have access to the territory in which they live. Of course serve useful function in satisfying man's desire for beauty in nature.	Role in Nature much like that of other damsel flies and based on habit of eating other insects that may be helpful or harmful to man's interests. Transformation from nymph to adult takes place only a few inches above the surface of the water that has been left by the climbing animal.	Useful in two or more ways. Serves as control of other insects of the environment and as food for fish, insects and birds nearby. Nymphs and adults might be used as fish bait but more robust forms would be preferable in many ways. All damsel flies are interesting to naturalists, of course.

NAME SCIENTIFIC NAME	FORKTAIL DAMSEL FLY *Ischnura verticalis*	BLACK DRAGON *Hagenius brevistylus*	GREEN DARNER *Anax junius*	BLUE DARNER DRAGONFLY *Aeschna constricta*
DESCRIPTION	Length to over 1 inch. Wing expanse to 1½ inch. Male and female show color differences. Males are green and black, with the 8th and 9th abdominal segments blue, with a black stripe down each side. At rest wings are held folded above the back is in other damsel flies.	Adult length to 3-1/5 inches. Wing-spread to 4-2/5 inches, making animal one of our largest dragonflies. Body stout. Legs long and black. Wings clear, long, powerful. Clasping organs short and blunt and rear of abdomen expanded. Eyes prominent and occupying over 2/3 the width seen from above.	Adult length to over 3 inches. Wing-spread to over 4 inches. Thorax green. Abdomen bluish. Face yellow. Legs black and reddish. Wings clear or yellow tinged. Abdomen pale at base. Best character of animal in flight is that of being greenish and large. Tireless flier and with gauze wings is a marvel of beauty.	Adult length about 2-1/3 inches. Wing-spread nearly 4 inches. Face yellowish. Thorax brownish. Legs black. Wings relatively clear but with small dark spots in front of the wing-tips. General effect bluish. Adults appear like husky insects and are capable of powerful flight high in air and at good distances.
RANGE AND RELATIONSHIP	Order Odonata. Family Agrionidae. Not commonly found over open water, but one of the commonest damsel flies in the United States to be found around swamps and waterway borders. Adults found through summer season active from dawn to dusk, but not found in great flocks like the may flies, midges and caddis flies.	Order Odonata. Family Aeschnidae. Ranges from Maine to British Columbia and south to Maryland and Texas. Individuals range rather far from breeding pond or other running water which it favors. Female may be seen laying eggs while in flight dropping to water at widely separated points freeing 10-20 eggs at a time.	Order Odonata. Family Aeschnidae. Ranges through most of North America where freshwater breeding areas are available and even sometimes remote from them. Adult stage probably lasts only a few weeks. Color changes take place and at end body may appear almost hoary.	Order Odonata. Family Aeschnidae. Ranges from the Atlantic Coast west to the Dakotas with related species covering most of the continent. Strong, high fliers, being found sometimes miles from breeding area coursing high over grain fields and other open areas but returning to pools to place eggs.
REPRODUCTION AND JUVENILE STAGES	Mating takes place most commonly in June and July. Eggs are laid in water and hatch into nymphs that eventually reach length of 3/5-inch. Move by sideways switching of body, walking or darting forward by expelling water. Nymph stage may be long, over winter. Wing pads appear in later nymphal stages.	Mating takes place in flight preceded by erratic behavior. Female drops eggs in flight unattended by male. Nymph develops under water usually in trash on the bottom. May require a number of years in nymph stage. Transformation on logs or support near shore, on land but usually within a foot of water.	Mating is preceded by erratic flight. Male grasps female by neck region with tip of abdomen, and her body bends to meet his sex organs in thorax region. Eggs laid under water with female alone or accompanied. Eggs hatch in about 3 weeks from protecting plant tissue. Nymph immediately on its own.	After mating the female, unattended by male, lays eggs under water just below surface in plant stems. Eggs hatch in about 3 weeks and nymphs begin life of foraging among water plants for a living. Plan of attack is to remain stationary until prey approaches, then grasp with extended jaw, or may stalk prey first.
ECOLOGY	Both adults and nymphs feed on insects and other small animals captured by pursuit or stealth. Nymphs may fake death by lying on back in water if captured, but may suddenly come to life and spurt away by expelling water from gill area. Less limited in activities by light than are most damsel flies.	Food of adults and of nymphs, insects and other small animals that can be overcome. At no stage are they capable of harming man, or do they have mystic powers in helping snakes that are in distress. The adult animal is a thing of beauty at rest, or in flight, and as such if for no other reason should be protected.	Nymph stage lasts about 11 months during which there are molts of skin. It captures food by lying in wait, or stalking, and finally grabbing with extended lower jaw, which may have length of ¼ the body. Food is any animal small enough to be overpowered. Harmless to man.	Food of both nymphs and adults is animal life they can overpower. May destroy fish eggs or young fish, tadpoles and similar creatures. Insects caught in air are usually carried to resting place and devoured at leisure. Prey may be either useful or harmful to man's interests. Make good trout bait.
ECONOMIC IMPORTANCE	As nymphs and as adults prey on smaller animals, helping keep them in check. May be considered as fish food, and while some artificial flies are modelled after the fork-tail, the animals themselves are too small to be used practically in this way.	Of no great economic importance, probably. Nymphs may be used as fish bait but are not so suitable for this as are the nymphs of *Anax* and *Aeschna*, described in other columns. Nymphs might be harmful to fish nests and to young fishes, but adults are so beautiful that it is hoped they may be spared.	Excellent check on multiplication of small animals of environment. Nymphs may be 2 inches long and have commercial value as fish bait, with names such as perch-bug, bass-bug, what-is-it and dragonfly nymph. Nymphs can dart forward by expelling water rapidly from body jet propeller fashion.	Adults known as devil's darning needles, snake doctors and dragonflies but are probably essentially of neutral value. Are pleasing to the sight in rest or in flight. Nymphs known as bass bugs, what-is-its, and perch bugs. With other dragonfly species in one year in New York they had value of $2837.69.

THE WIDOW DRAGONFLY *Libellula luctuosa*	WHITE-TAIL DRAGONFLY WHITE-TAIL SKIMMER *Plathemis lydia*	WINTER STONE FLY *Taeniopteryx nivalis*	EARLY SPRING STONE FLY *Allocapnia (Capnia) vernalis*	LATE SPRING STONE FLY *Pteronarcys dorsata*
Length of adult to nearly 2 inches. Wing-spread to 3-2/5 inches. Seems to be a blackish dragonfly with broad dark bands at the bases of all wings and body brown, striped rather inconspicuously with yellow, but in age upper part of body becomes bluish with a bloom.	Length of adult to nearly 2 inches. Wing-spread to 2½ inches. Conspicuous differences in the sexes with wing patterns shown in illustration the male to the left. Notice also parallel sides of female abdomen and tapering tip in the male. Colors and spots change with age of individuals.	Length ½ inch. Slender, blackish brown with smoky wings rather transparent and equal length of body from snout to tip of abdomen. Antennae held to the fore and about, but not quite, equal length of body. Head narrower than thorax and rather squarish when seen from above. Wings overlap flat at rest.	Length of adults less than ½ inch, with males smaller and more slender than females, dark brown to blackish. Hind wings plaited or folded to lie under forewings when at rest. Terminal appendages of abdomen extend beyond the tips of the wings. Antennae held to the fore.	One of the larger stone flies, with the nymph measuring to over 2 inches and the adult with appendages exceeding that measurement. All stone flies have 2 claws per foot, as contrasted with 1 claw in may flies. In *Pteronarcys* the wings exceed the 2 terminal abdominal "tails" and hide them.
Order Odonata. Family Libellulidae. Ranges from Maine to Florida and west to North Dakota and New Mexico. Closely related Ten-spot, *Libellula pulchella*, was figured and discussed in the 1st insert of this series. The widow is especially common in ponds of the Mississippi Valley.	Order Odonata. Family Libellulidae. Ranges from Newfoundland to North Carolina and west to California and British Columbia. Characterized by being active, probably as long a season of the year as any dragonfly, with older animals graying with age.	Order Plecoptera. Family Perlidae. Found in eastern and central States of the United States, south as far as North Carolina. Found on snow or swarming on supports near swift water of fresh-water streams. Adults do not seem as alert as do the nymphs. Often abundant in great numbers in a locality.	Order Plecoptera. Family Capniidae. Only one species is to be found east of the Rocky Mountains, although several closely resembling it are found in closely related genus in northeastern North America. May be found crawling over snow like the closely related winter stonefly, *Taeniopteryx nivalis*.	Order Plecoptera. Family Pteronarcidae. Range includes territory from eastern States through Tennessee and Minnesota and north to Alaska. Territory in which they thrive is that of small creeks and rivers, where there is accumulated decaying plant material. Adults commonly found clinging to vegetation.
Mating takes place on the wing soon after emergence, which begins in May and may still be observed in September. Eggs laid by female, unattended by male, hatch into ugly looking nymphs, which live in muddy bottoms masked with silts and which may reach a length of 1 inch. Transformation usually on grass.	Females hiding among vegetation are sought by bolder males. After mating female, unattended by male, lays eggs in water, repeatedly dipping abdomen in water in flight at one spot, freeing 25 to 50 eggs at each dip. Nymph a squat, ugly looking creature that lives on bottom.	In northern part of range, from February through May, adults may be found emerging from water, where shed skins may appear in layers at water's edge. Adults mate then lay eggs in stream and die. Mating takes place away from water, but eggs are laid in water. Adults are short-lived.	Adults emerge from the nymph stage, leaving the water and taking to land from January through April in much of the range. Fly awkwardly or crawl upward and mate, after which females return to water to lay eggs. Eggs hatch into nymphs that may develop until emergence of next year.	Adults emerge in May and June and may be found emerging first in lower warmer stretches of the stream. Adults mate then lay eggs in the water. Nymphs develop from eggs and may require more than a year to reach maturity during which time they go through a number of molts naturally.
Adults and nymphs feed largely on insects. Adults are eaten by birds and nymphs by fishes. Ants kill many newly transformed adults, destroying their wings before they become completely expanded. Adults are not difficult to capture when they come to rest on grass stem or some bit of twig.	Food of adults and nymphs insects and other small animals caught in flight by adults, and largely by nymphs, by lying in wait on muddy bottom of waterway masked by muds on hairs, but ready to thrust lower jaw violently forward to capture a meal.	Adults do not eat, fly little, are probably more active in night than in day, and have tendency to keep crawling to higher and higher points, often crowding around tops of posts, stones or other structures they start on. Emergence is from stones, usually in swift water.	Adults are short-lived and probably eat nothing, even though they seem to have functional jaws on a superficial examination. Nymphs feed on plant and animal matter under water, and require water with high oxygen content. Show much disturbance if water is not fresh and cannot long live in aquaria.	Food is essentially plant material so they definitely provide a link between decaying plant material and the food needs of insect-eating animals such as fish. Trout feed ravenously on the newly emerged adults, so both they and the nymphs made good bait.
Insects of beauty, such as the adult widow dragonfly, should always be present to make a field trip a bit happier. If merely seeing the animal may be accompanied by witnessing courtship, mating or feeding and egg laying the experience is worth that much more. Nymphs in aquaria are also interesting.	Economic importance is probably small. Nymphs may be of value as fish bait, but are not so easily harvested as are those of the darners. Also because of their position on bottom are not as likely to be captured by their enemies and may remain a menace to young fishes longer.	Nymphs live on both plant and animal matter, thus turning these materials into other animal matter that is eaten by other insects and by fish. The members of this species are too small to be used as bait, but they are eaten by fish nevertheless. Emergence commonly in February.	Essential role is that of providing food for fishes by assisting in converting plant material to suitable fish food, even though they may also eat some other insects as well as the plants. Interesting because of their behavior in early spring.	Large enough to be put on fisherman's hook to catch trout. Trick usually is to collect insects downstream and then use them upstream, where emergence is to be expected and where fish do not long hesitate to take the bait for a meal.

(Continued from page 139)

able feat and in the dragonflies alone we have those that can soar to great heights, while other forms are much less able. Ordinarily we cannot consider that stone flies, orl flies, or dobson flies are superior fliers. They neither fly rapidly nor can they long sustain flight. This, in part, may be because they do not seek prey during their relatively short lives as fliers. The may flies, however, usually have even shorter adult lives and seek no food, and yet they sometimes seem to fly rather well. They cannot as adults match the dragonflies, whose lives depend on their ability to catch other insects.

The immature stages of these insects display a variety of means of locomotion, as you may discover should you keep them in an aquarium or seek them in the field. These means usually are modified by the type of water in which the animals live. Inhabitants of swift water vary from those that live in quiet water; burrowers differ from those that seek food in open water. To a considerable extent locomotion of the immature stages has been discussed in the chart section of this insert. If you wish to study this on your own here are a few points.

Many of the immature stages of these insects move by walking with orthodox legs. The burrowers, whether they are may flies or dragonflies, behave differently. The prowlers, like the nymphs of the darners, combine walking with jet propulsion, filling their rear parts with water and expelling it quickly so that they dart ahead violently. You may see this if you confine one of the nymphs in a shallow dish with mud or ink in the water.

Of great interest to many is the way the dragonfly nymphs are able to capture food without moving their bodies. If you will look at the lower jaws of these creatures you will find that they are strangely hinged. The jaw is doubled back under the head with two hinges, and the free end has hinged parts that make a formidable structure for grasping food. This jaw can be darted forward with lightning speed, and woe be a prospective meal that approaches the animal.

Catch a few larvae of the dobson fly, orl fly, or fish fly and observe their eating habits. Their jaws are really powerful. Notice, however, that some of these animals can give off a dark substance when they bite, while others do not. It reminds one of the "tobacco spit" of some grasshoppers.

Even the simplest motions of some of the immature stages of these insects are worth studying. Watch the motions of a damsel fly nymph and you will be reminded of the hip motions of some other damsels. Watch how the nymphs of may flies move their bodies up and down rather than from side to side. They seem to say "howdy" and some are spoken of as howdy may flies.

Notice the movements of the gills, or gill parts, in the immature stages of some of these insects. The position of the gills may give you a quick clue as to the identification of the animals. May fly nymphs commonly have their gills exposed along the sides of their abdomens and may have 2, or, more commonly, 3 "tails." Stone fly nymphs, on the other hand, may have the gills in patches near the bases of the legs, or they may have them placed otherwise. They appear to have but 2 "tails." Damsel fly and dragonfly nymphs do not have gills exposed as they are in the may flies and in some stone flies. The damsel flies may show 3 tails, but they are usually broader than those of the may flies. In dragonfly nymphs these tails are reduced, as a rule, to short, stubby structures, and the animals may appear to be tailless.

To a biologist the story of reproduction of an organism is always interesting. Water insects are intensely intriguing in this respect. In the group to which the fish flies, alder flies and dobson flies belong we have the four stages that insect students consider as representing a complete metamorphosis. There is the egg, the larva, the pupa and the adult. In the may flies an almost unique system is followed. There is the egg, which hatches into a nymph whose function is to increase in volume. When the nymph is mature it emerges from the water and a most remarkable thing then occurs. What appears to be the adult stage is divided into two stages separated by a molt. We speak of the first of these stages as the submago, or dun stage, and the second stage as the imago, adult or spinner stage. Usually the insects appear more glamorous in the second stage. In this second stage the insects mate and the eggs are laid. These two final stages may be completed in a 24-hour space, or they may last for two days. It is in this stage that the animals reach the climaxes of their lives. They fly. They breed. They lay eggs. For the rest of their lives they have merely eaten, or avoided being eaten.

In the dragonflies and damsel flies many interesting reproductive behaviors may be observed. You can see the females laying their eggs, either by repeatedly dipping the abdomen in the water at the same place while in flight, or by dropping the eggs at intervals. Or, again, we may find the male clinging to the female, even when she goes under water to lay her eggs.

The story of copulation is interesting because you can easily see the mated pairs in flight at times. The male commonly has grasped the sometimes duller female by the back of her neck with the end of his abdomen. In this position they may remain at rest or in flight for some time. When conditions are right the female brings the tip of her abdomen around to contact the region where the abdomen and thorax join in the male. Here the two join to produce the fertile eggs.

We could go on indefinitely telling you of the interesting stories of these insects, but the real function of these inserts is to start you to looking for things yourselves.

These insects are misunderstood by the laymen who have many superstitions about them. Not a few textbook writers ignore them completely, or misrepresent them, as I have indicated earlier. In few, if any, cases are they of major economic importance directly, but without may flies the raising of fishes would be a complicated problem, so they have some importance. There are many other angles that might be presented, but with this we will wish you luck and understanding in your future relation with these often misunderstood insects.

True Shamrock

By ALMA CHESNUT MOORE

WHEN is a shamrock a shamrock? After an exciting chase through four dictionaries and one encyclopedia, the inescapable conclusion must be reached that there is no such thing as a "true shamrock." A shamrock is a shamrock when it is worn as such in an Irishman's lapel on St. Patrick's Day.

The word itself is derived from the Irish, *seamrog*, meaning trefoil and applied to various trifoliate plants native to Ireland, and even to water cress, which is not three-parted. So says *Americana*, and adds: "Each is said to be the plant picked by St. Patrick as a symbol to illustrate the doctrine of the Trinity. The black medic, *Medicago lupulina*, *Oxalis acetocella*, various clovers such as the common red clover, *Trifolium pratense;* a trailing hop clover with small leaves and trailing heads, *Timinus*, and the common low white clover, *T. repens*, are sold widely as the 'true shamrock' and exported in large quantities to the United States and other countries, where Irishmen make a custom of wearing the sprays on St. Patrick's Day as a reminder of home associations."

Sergeantson's *Dictionary of Foreign Words in English* notes that the word "shamrock" slipped into the English language from Ireland in Campion's *History of Ireland*, in 1571.

The *Oxford Universal English Dictionary* attempts to narrow the hunt down a little. According to this source the shamrock is "a plant with trifoliate leaves, used (according to a late tradition) by St. Patrick to illustrate the doctrine of the Trinity and hence adopted as the national emblem of Ireland." It adds parenthetically: "The name is now commonly applied to the lesser yellow trefoil, *Trifolium minus*, the plant as an emblem on St. Patrick's Day."

Old Noah Webster did not mince words or get fancy about it: "Shamrock. Any one of the various trefoil plants native to Ireland, embracing the white clover, black medic and wood sorrel. The Irish national flower."

Century Dictionary generalizes: "A plant with trifoliate leaves; the national emblem of Ireland." Then it goes scientific, quoting Britton and Holland's *English Plant Names*, to wit:

"The plant at the present day most in repute as the true shamrock is one of the hop clovers, *Trifolium dubium*, a slender, trailing species with small yellow heads, perhaps a variety of *T. procumbens*. It is in use in many counties of Ireland and forms a great part of the shamrock sold in London on St. Patrick's Day. The black medic, *Medicago lupulina*, is also thus used, but the white clover, *T. repens*, is widely understood to be the common shamrock. The identity of the original shamrock, which St. Patrick used. . . .is uncertain. It has been variously supposed to be the common white clover, *T. repens;* the red clover, *T. pratense;* the wood sorrel, *Oxalis acetocella* (locally called shamrock in England,) and even water cress."

But all this gets an Irishman nowhere. If it is green and has three leaves, stick it in your buttonhole on March 17. It will be a shamrock all right.

★

Turtle Totin' Time

By HELEN WARD GALL

It's sulphur and molasses time — the dogwood is in bud —
The frost has gone and left the earth a soft, warm sea of mud.
The artist dusts his easel off — the poet starts to rhyme:
It's springtime in the country — and it's turtle totin' time!

Old Aesop in his fable of the tortoise and the hare
Had slow and steady win the race; but he was unaware
Of what the modern turtle must compete against today
Since streamlined cars on streamlined roads replace the one-horse shay.

The turtle isn't supercharged, and wasn't built for speed.
When Grandpa Turtle was a boy there wasn't any need
To hurry 'cross a country lane to get on 'tother side;
Vehicles then were slower, and the roads were not so wide.

Alas — the price of progress! At his grandpa's same old pace
It's scarce to be expected he could win the modern race
Across a modern highway with his house upon his back
Before a car comes whizzing by to stop him in his track.

No sooner is the winter done and ice is off the brook
I know that as I drive along I have to start to look
For traffic moving leisurely across my hurried way —
"It's turtle-totin' time again — it must be Spring!", I say

And stop to pick the culprit up and carry him across
The side where he was headed, to the bushes, grass and moss.
What matter if I'm late for work? That isn't any crime!
It's Springtime in the country, and it's turtle-totin' time!

A harbor, or hair, seal pup is an appealing little animal, but these seals are being killed for bounty throughout maritime Canada

Hair Seals in Danger

By N. J. BERRILL

Photographs by the Author.

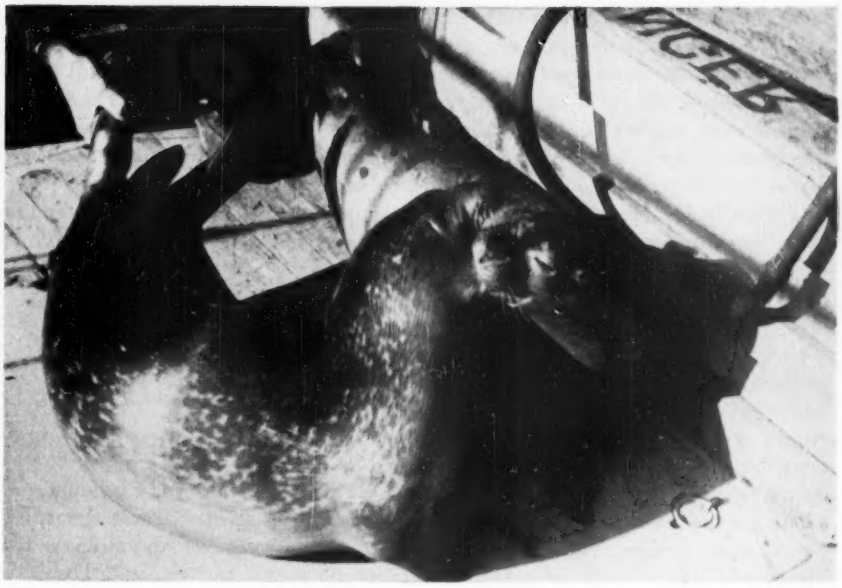
SEALS have hairy coats, and, according to their quality, mankind covets them. The Alaska fur seal is so valuable and so well managed that it now receives the protection it needs for its survival and increase. The harp seal of Labrador waters has a poorer fur, but the woolly coat of its pup is desirable, and nearly a quarter million young seals are slain each spring in unrestricted greed. And even the coarse, straight-haired coat of the harbor seal has a market value, although its owner is endangered not so much by its warm covering as its parasitic worms and its liking for fish.

Unfortunately little feeling is found for the harbor or hair seal because of those who contend that it affects the quality and quantity of fish that reach our city restaurants, and in many places it is shot on sight. In places on the West coast both machine-gunning and dynamiting have been advocated. Yet these seals are gentle, curious, intelligent creatures that conflict little with human interests. They are warm-blooded, hairy mammals that, like ourselves, breathe air and bring forth their young alive. And, rare in the animal kingdom, is the fact that both seals, like men, have a sense of fun, even when they are fully grown. Seals at play, in fact, are always fascinating to watch, whether among the sea and rocks, where they belong, or in a seal pool in a zoo, or at a circus.

Of course, there are seals that are relatively safe because they live far enough away from man and are not numerous enough to be of economic value to him. The leopard seal, for example, is found in Antarctic waters, where it awaits the penguin off the edge of the southern ice, and fears killer whales more than humans. Killer whales have been feeding on seals of one kind or another for a time long before man even existed. One of the few killer whales ever examined contained twenty-four seals in its stomach, and another had eaten fourteen seals and thirteen porpoises. It is no wonder that when these killers are around, seals will come right up to the shore despite the presence of human onlookers.

Seals have their mystery, like most sea creatures, and one of the greatest are the travels of the fur seal around the trackless Pacific and back to the tiny northern islands. There was another mystery when, only recently, a large fur seal colony on the east coast of South Africa pulled up stakes in the middle of the breeding season and put out to sea, to go no one knows where. Newly born pups and untrained young were left abandoned on the shore behind them. They have not been heard of since. Did some Pied Piper of the oceans call them to their doom, or have they found their way to some remote island? If the African herd can behave in this manner, might not the Pribilof seals do the same.

My own experience of seals is limited to the friendly harbor seal on the Atlantic coast. It is always there, going about its own quiet business in the coves and



Two hair seals, brought into the boat, squabble. However, they quickly become half tame, females in particular.

among the islands. Fishermen there have no harsh feelings towards it, as others have toward its kind on the Pacific coast. On the Pacific coast harbor seals are likely to take their toll of salmon on the run, or when caught in the gill nets, although salmon are but a small part of their diet, — in fact, recent investigations in British Columbia place the salmon well down on the menu, where rockfish, octopus, and various fish other than salmon take top place. Yet fishermen from California to Alaska regard the seals as unfair competition and shoot at them on sight. Pups are killed so that the mothers may be the more easily destroyed while looking for them.

Along the eastern coast there are perhaps fewer fish, fewer fishermen and fewer seals, but mankind is still a menace to a friendly mammal, and for a reason I am ashamed of, the more so because I have myself been an onlooker in part of the story.

It starts this way. The harbor seals are common along the coast of Maine, and spend their lives, as a rule, within a few miles of where they were born. They are no seafarers and stay close to the coastline. They do not seem to be able to sleep in the water, but have to come ashore by day or night to rest, depending on when the tide is low and rocks uncovered. And they are born ashore and have to be taught how to swim like any landlubber. Mating takes place in the fall, among males at least three years and females two years old. In the spring the females go to the quiet, sheltered waters of the long, salt-water inlets, the drowned glacial valleys of the last ice age, and each gives birth to her plump, woolly-coated baby in seclusion below high, spruce-covered river banks. The soft coat is soon shed and the thirty-pound youngster is taken into the water. Swimming comes easily, and submersion, too, for valves in the nose and ears close automatically as the young seal goes under. For the most part the pups suckle on shore, for at first their endurance in the water is limited. But after two or three weeks they are strong enough to accompany their mothers on fairly long foraging trips, feeding on alewives coming in from the sea on their spring spawning run, and on clams and crabs when there are no fishes.

Looking down at a hair seal pup swimming in the water.

It was in one of these nurseries I first came to know the pups for what they were, when I went along on the boat from the local fish hatchery to catch a supply, some of them to be sent away to various destinations, some to the city park at Boston, some by air express to Texas, and others to fishery laboratories investigating seal parasites, for seals

carry roundworm parasites in their intestines.

We had come in from the sea, past small islands and ledges, where the male seals lolled and fished with no responsibilities toward their progeny, and entered the long, narrow, salt-water inlet. About ten miles from the mouth rocky ledges stood out from the shore, and it was here we found the mother seals with their pups. The time had to be right, just when the pups were being weaned, for if too soon it would be difficult to keep them alive, and if too late they would be gone from the nurseries and almost impossible to catch. As it was, some had recently left their mothers, while others were still under escort. So seine nets were strung across the gaps between the ledges, leaving only upstream openings, and one by one, during a long day of waiting, pups drifted down and became entangled. Then came the struggle of getting them into the dory, and finally to the deck of the fisheries vessel, where they soon quieted down and became half tame. The female pups were gentle from the first, while the males were the more ticklish on the soles of their flippers. It was a pity to catch them, for even a city park is a poor substitute for the cold Atlantic ocean, and more of a pity that any of them should yield facts detrimental to their race.

The trouble is that cod, especially the inshore catch that is taken extensively off the coast of eastern Canada and frozen as fillets, also get infested with roundworms, which become encysted in the flesh. City folk eating these have objected strongly and have complained to the packers when they have found a worm, as well as fish, before them. Not that a well-cooked roundworm is any more dangerous than a caterpillar in your cabbage, but as a race we are choosy about the meat we eat.

Now roundworms, whether of the cod or some other animal, generally have an involved life history. As the result of certain investigations on seal pups and other creatures, the cod worm is considered to need three kinds of host animals in which to live out its life — a small crustacean, a fish, and a mammal. We do not know what crustacean it is, and could not do anything about it even if we did. But the harbor seal carries what seems to be the same worm as the cod, although there is still a little doubt about this, and the theory is that if the seals are killed off, the worm cannot complete its cycle of growth and will die off, too. Cod, in turn, would become wormless, and human fish eaters happier!

Unfortunately the theory has been put into practice. In order to appease the fish packers — as if human beings have exclusive rights to all that is alive on earth! — the harbor seal is being killed off throughout maritime Canada. The Canadian Department of Fisheries offers a ten dollar bounty for grown seals killed, and even the harbor seals and the gray seals on the Magdalen Islands, controlled by Quebec Province, are under bounty.

This is no more than a wanton destruction of a harmless and attractive fellow inhabitant of this planet. I doubt whether the cod has fewer worms, or that it really matters very much whether it has or not! Smelt also carry the worm, and can pass it along to the cod that eat them. Porpoises probably have the same worm, but they cannot be caught, and every spring the harp seal migrates into the Gulf of St. Lawrence from the north and serves, for a while at least, to spread the worm through the cod community. All this assumes that the theory is correct, but even if it is, it seems to me to be a pointless vandalism that does nothing but make it possible to say that, justified or not, some action is being taken, so that complainants about round worm perhaps will feel mollified.

I feel strongly about the harbor seal because it is a friend of mine. But what of the harp seal, a little farther north? Every spring these seals come down from the waters of the sub-Arctic islands and the coast of Greenland to give birth to their young on the ice off Labrador, and they come by the hundred thousand. As a matter of fact, the southward migration starts in the late fall, when the ice begins to form, for, unlike other seals of the far North, the harps do not make breathing holes in the ice and are obliged to move away. They give birth to their young on the Labrador ice sheets during the first week of March. The pups are weaned within two or three weeks and the adults then mate immediately.

All of this allows the sealers just time enough to make two trips from the Newfoundland harbors. On the first trip they take practically nothing but pups, for the pups have a lovely, stiff, white, woolly coat that has a good market value. After these have been taken back and unloaded they return for the adults, for they can be boiled down to make a fair amount of oil. *And there is no limit on the hunting.* In recent years, since Russia has closed the White Sea to other nations, the Norwegians have been coming across the Atlantic to join the Newfoundlanders in the annual slaughter. In 1951, more than 350,000 seals, of which 220,000 were pups, were taken. No animal stock can stand depredation of this kind for long, particularly when the main crop is taken from the new generation. (Continued on page 162)

The Break in the Beaver Dam

By AUGUST DERLETH

This break's man-made beyond a doubt,
by someone knowing what he was about,
neither too wide nor yet too deep —
what beavers meant to keep will keep;
and yet within one night the dam is
mended,
though nothing shows by day that it
is tended.

The littlest break can send a wall
or dam as well to its downfall —
something a beaver knows or senses.

A pity a man's less careful of his fences.

Sangamon Springtime

By VIRGINIA S. EIFERT

Photographs by the Author

". . .and winter held closely the prairie cabin."

IT WAS March in the Illinois Country; springtime at last. As the great drifts melted and the streams ran full, and all the prairie was a morass of mud and water, three men set out in a cottonwood canoe down the Sangamon River. Abraham Lincoln, with John Hanks, his cousin, and John Johnston, his step-brother, had been hired by the voluble and inconstant Denton Offut to pilot a flatboat loaded with produce to the markets of New Orleans. After the dreadful inactivity of the "Winter of the Deep Snow," action like this seemed glorious.

They would never forget the winter of 1830-31, nor would some of the wild things ever quite recover from its devastating effect. Dennis Hanks, Levi Hall, and Tom Lincoln had completed a cabin on the prairie near Decatur, in which the three families, just come from disappointments in Indiana, would live. The autumn was mild and fine, and folk cheerfully predicted an open winter. Geese stayed late on the grassy ponds and corn still stood in the fields. Wild turkeys fed upon acorns until gobblers and hens were sleek and fat. The prairie chickens performed their springtime booming and strutting as if it were March again. Deer never were so abundant, old-timers said. The Lincoln clan was thankful to have come to such a fruitful and pleasant land.

Snow began to fall on Christmas Day; snow at last. All day it fell, gently at first, whitening the ground, then harder and harder as night came on too soon. The wind began to blow. Snow blew on a screaming wind until the air and earth seemed to be one in the driving whiteness. People were lost in it. Animals were caught in the fields. Sheep and cattle died of cold and hunger before their frantic owners could find them and lead them into safety. Corn could hardly be harvested, for now, as the drifts piled higher, only the tops of the shocks poked through the snow.

The snow blew and the wind raved, and winter held closely the prairie cabin, the log house in which lived thirteen people — children and adults — in a space that rapidly became too small, too crowded, too cramped.

Now the snow stood fifteen feet deep in drifts on the prairie. It lay four feet deep in the woods, and food for ground dwellers was covered. Rain one mild day crystallized in an icy crust and, when cold returned, men at last could venture out on a world nearer the sky than it was before the winter began. But the crust was almost worse than the soft drifts. Many of the deer had not been able to flounder through the soft snow; now on the crust the survivors floundered and fell, and the wolves caught them. The wild turkeys grew gaunt. When finally they could find nothing more to eat in the woods, the wolves ate them, too. At night, it seemed to the people in the snowbound cabin that there was nothing left of the world but snow and bare trees and the howling of wolves across the moon-sparkling crust.

And when at last spring came, it was no wonder that Abraham Lincoln, twenty-two and full of enthusiasm, health, and pent-up strength, was glad to get away from that prairie cabin, away from the long winter, away to see something of the world.

And then when the party reached Denton Offut at Springfield, for a while it seemed as if the whole glorious adventure would fail. Offut simply had neglected to procure a flatboat to carry his produce to New Orleans; but Abe Lincoln, with the memory of that winter burned into his soul, would not be stopped for want of a boat. Perhaps for the first time in his life, he asserted himself. They would build a boat for Denton Offut — and for Abe Lincoln, too.

So the three went to the river bottoms below Sangamo Town, seven miles northwest of Springfield, and built a shanty on the shore where they would live. Nearby they set about to build a flatboat eighty feet long and eighteen feet wide, a craft to carry a valuable cargo of hogs, flour, cornmeal, and salt pork down a thousand miles of three rivers to New Orleans.

Backwaters of the Sangamon River near the site of what once was Sangamo Town.

Sangamo Town had risen from an Illinois clearing only a few years before, and in another few years it would vanish completely. But the story of the site of Sangamo Town is more ancient and more enduring. Abe Lincoln had come to a place where, two hundred and fifty million years before, an ancient ocean had spread broadly across the land. In that ocean's shallows there lived myriad small snails, clams, crinoids, and corals, which, over millions of years, became fossilized. Finally, as the Carboniferous seas went away and the land dried, there came a humid, swampy forest of great fern trees, which, when they fell into the mud, laid a thin layer of coal above the layer of blackish, fossil-filled limestone, which was all that remained of the ocean.

Time moved on. At last there came a glacier out of the north, and for thousands of years it and its successors covered all this land beneath ice a mile thick. But even glaciers are transient, and when at last the ice retreated toward the north, melt-water poured down the country in channels which were rivers. Now along the Sangamon, a broad and violent river that rushed seaward across a thawing land, mastodon and mammoth came to wallow and drink. On the river shores the giant beavers with their six-inch orange incisors cut down poplar trees; herds of musk-oxen drank here and then trotted away across the wet Illinois marshes.

Ages passed. The river grew narrower. Indians came here to hunt. The Kickapoos may have come from Kickapoo Town not far to the north, and long before them there may have been others, the Hopewellians, for many an ancient stone arrowhead was left on the uplands by a vanished people. In 1814 a bounty of fifty dollars was put up for any "depredating Indian brought in alive or dead." Since the bounty on wolves was only two dollars, the wolves in Illinois lasted longer than the Indians.

Then, on a hot June day in 1824, the new village of Sangamo Town was begun in a raw clearing on the hilltop above the ancient Sangamon. Below the town lay that rocky section of the river where fossils forever weather out of the rocks.

Daily, men of the village followed the hill trail to the bottoms to see how the boat was progressing. Abe and his kinsmen welcomed visitors — even put them to work — but did not let them interrupt the undertaking. The boat must be on its way before the spring floods subsided. Now, as they labored, spring moved in all around them.

It was spring in all the Sangamon Country. The geese on damp March days and misty nights headed north to their Canadian breeding grounds. Teals and shovellers dabbled in the lowland swamps across the river, and the grassy prairie marshes were tenanted by thousands upon thousands of curlews, which would fly north in tremendous flocks to Alaska and arctic Canada. One day the woods suddenly were full of passenger pigeons, whose weight

Through the doorway of the Rutledge Tavern at New Salem State Park restoration.

broke branches from the maples and swayed the sycamores. The villagers came with nets and shotguns and caught hundreds before the woods were cleared, and the horde in great processions took wing across the sky.

Yet, although the migrants were abundant, the resident creatures of the Sangamon Country were scarce. The Winter of the Deep Snow had taken a terrible toll. The few deer that remained were poor and scrawny, racks of bones covered with dull and matted hair. The wild turkeys seemed to have vanished. Never again were they seen in abundance in Illinois. But the prairie chickens still were about. They had survived, no doubt, by eating buds of basswood, elm, and poplar. Now out on the short-grass prairie the cocks were dancing and booming and bowing, uttering that long, eerie "oooooooo-ing" sound as the April sunrise moved mistily across the old, wet, bentover grasses.

A phoebe built a mud nest under the eaves of the shanty on the shore and decorated the damp mud with green mosses. At night the barred owls shouted and yapped and purred at their courting in the old trees of the bottoms, and a red screech owl wailed on the shanty roof until John Hanks threw a stone at it to scare it away. Owls brought bad luck, he said, especially red screech owls.

Spring came into bloom. By mid-April they were all there, the flowers of the Sangamon country, by hundreds, by thousands, on those unpastured, unlogged, virgin slopes. . . the crisp white foam of Dutchman's breeches, and squirrel corn, perfuming as with hyacinths the leafing forest. . . white adder's tongue (the yellow did not grow here, only the scented white with the spotted silver spears of leaves) uncurled its petals. The satiny leaves of wild ginger carpeted the slopes, along with blue phlox, spring beauties, and red trilliums. Wild plum thickets scented the soft spring nights with a fragrance that made Abe Lincoln ache with a queer pain that somehow was both sad and happy, all at the same time.

Spring brought the white adder's tongue, the scented white with spotted silver spears of leaves.

With spring came the wild blue phlox that grew on the slopes with the wild ginger.

It was spring, and now it was April 18, 1831. On a bright morning when all the village assembled on the shore, the huge, ungainly flatboat slid into the churning brown flood of the river. With its cargo in place, and Abe Lincoln, John Hanks, John Johnston, and Denton Offut as crew, the boat was on its way to New Orleans.

But once more fate seemed destined to put a halt to the adventure. By the end of the first day, the big flatboat had stuck on the mill dam below New Salem, and for a while it looked as if it was there to stay. Embarrassed by his failure as pilot, Abe Lincoln struggled with the boat, but it was not until next day that it was on its way into the clearer waters downstream and had passed the pecan forests of the lower Sangamon. Then the boat moved out into the rushing current of the Illinois, River of the Illiniwek, which pushed the flatboat past miles of a changing spring wilderness,

past the first of the dogwood flowers and the glory of redbud on limestone hills, to meet the Mississippi at Grafton.

On the great river, the flatboat did not seem so large. Down the twisting, cantankerous length of the Mississippi, the boat was navigated by the skill of a youth from backwoods Illinois. And a month after they left Sangamo Town, the crew tied up at the mile-long wharves of New Orleans. In their journeying the men left early spring behind them along the Sangamon and, visibly mile after mile, they had approached summertime in the South. It was a summer that lay embodied in plant life strange to Illinois — in fragrant white magnolia flowers, in azaleas and jasmine and roses, in full-leafed live oaks hung with Spanish moss, in concertizing mockingbirds, and white ibises awing.

Back in the Sangamon Country it was still spring, spring as it is today, yet as it never was again after farms grew where Sangamo Town died, and cattle were pastured in the river woods. Those woods still are there; some of the big old oaks and maples and sycamores possibly might have been there when Abe Lincoln labored on a flatboat on the warming days of a long-gone spring. The same flowers grow there, only not so many, and there still is a trace of an old, old wagon road winding through the wild ginger beds, up the hill to the place where once grew a village with more promise than the young Chicago. And still the Sangamon flows muddily over the blackish limestone of the old ford, where fossils forever weather from the rocks.

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Water Carrier Bees

By MARGARET GROSS GRIEBE

EVER since we got our first hives of bees, we have been learning, from books and observation, more things the little busy bee doth do. One thing we missed for a while was the existence of water carriers.

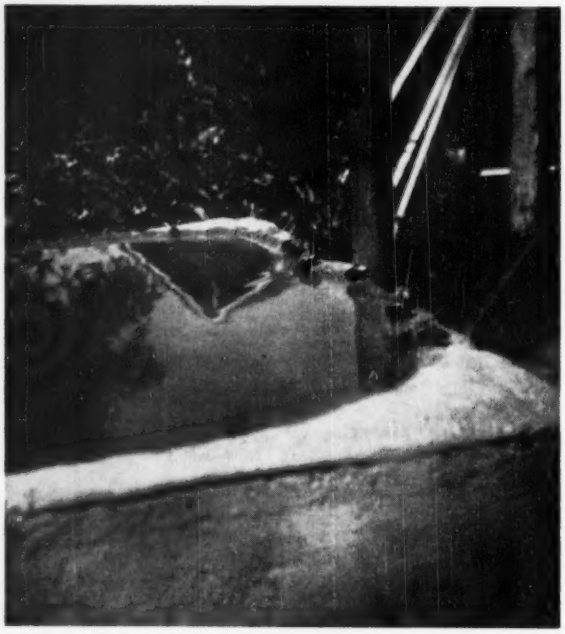
We knew the bees all had definite chores, such as the nursemaids, the nectar and pollen carriers, carriers of propolis, with which they glue the hive together, among other things. The young bees have chores inside the hives, the older ones outside, working themselves, literally, to death, wings frayed, body exhausted.

We had noticed bees drinking at the bird bath, but had assumed they just wanted a drink. It was not until later that we learned about the water-carrying crew, which brings in all the water needed by the hive.

The accompanying photograph was taken in late August when there was an unusually large number of bees at the bird bath. Although we keep a "bath" near the hives just for the bees, they prefer the bird bath because the sides slope more and the cement job is not so smooth, so there are damp places just above the water. They prefer to suck moisture here rather than at the edges of the water itself. When a bee falls into the water, as often happens, it can swim out with amazing ease, shake itself and fly away.

Some seasons and some years they use more water than at other times. Often it is used to cool the hive. Bees must have water to use sugared honey, or sugar fed them. It is used in preparing the food for the larvae. It may be mixed with honey for early spring brood and stored in cells near the brood, looking like mysterious new honey when there is no nectar at that season.

In looking through a hive we often find water stored in odd bits of comb along the tops of the frames. Experiments have been conducted to learn more about water carrying. When given colored water and all bees found at the water source were marked, other bees not marked soon showed the color through the skin of the abdomen. Sometimes certain bees act as storage tanks. At other times the carriers run about the hive parcelling out the water, drop by drop, to many bees, or giving most of it to one or two bees.



When the bees were first seen drinking at the bird bath it was assumed that they were merely thirsty. Later it was found that they were on the water-carrying detail, taking the much-needed water to the hive.

Little by little the mysteries of the life of honey bees is being learned, the dance which tells of a newly discovered source of nectar, the food that makes a queen instead of a worker and other details about a fascinating insect. There is yet much for all of us to discover.

Kings in Captivity

By RICHARD A. LOCKWOOD

"Look! There's one," my wife cried, pointing through the car windshield toward a section of black-top road. In the beam of the headlights we had caught a glimpse of a snake slowly crossing the road. I stopped the car quickly, backed up a short distance, and, with snake-stick, flashlight, and muslin bag in hand, leaped out of the car. The king snake had paused in his course across the road, his head raised, unaware of our presence. As we drew near, he became immediately on the alert, the forward third of his body drawn back in an attitude of grim defense, his tail vibrating nervously against the pavement. His tongue flicked in and out rapidly while he cautiously observed every move we made. The first advance of the snake-stick brought forth a series of vicious jabs of the king snake's head, each accompanied by a short, sharp hiss. But in a moment the noose was secured about his neck, and he was dropped in the muslin bag.

It was not convenient to place the newly captured snake in a cage that evening, so when we retired for the night, we laid the bag and its occupant on the drainboard in the kitchen. To my great surprise I was awakened at five in the morning by the noise of a solid object hitting the kitchen floor. I lay there a few moments, not knowing quite what to make of it. Then I suddenly remembered the snake. Hastening to the kitchen, I turned on the light and saw the king snake coiled defensively in a corner of the drainboard, the plastic tumbler it had knocked off lying on the floor. There was a neat little hole through the seam of the empty snake bag. Not having my snakestick on hand, and having no desire to be bitten by the small, sharp teeth of the snake, I started a sort of fencing routine with a small fishing pole until I was able to grasp the snake behind the head. The king snake immediately coiled tightly about my wrist; so tightly, in fact, that I could hardly get him off long enough to stuff him into a wide-mouthed gallon jar. I finally succeeded, although it is no mean trick to force thirty-eight inches of unwilling constrictor into a gallon jar. A pigmy rattlesnake, captured on the same collecting trip, was in this container, and when the king snake dropped in, the rattler immediately bit him. All in all the king snake had quite an exciting evening; as for me — I went back to bed.

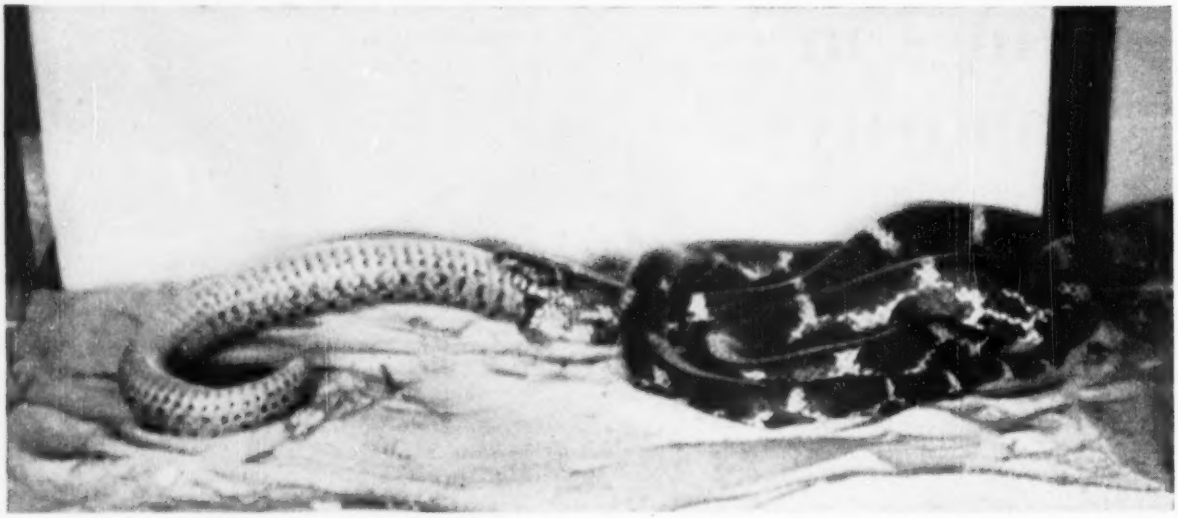
The vicious, and I am sure, usually successful defensive behavior of the common king

X-RAY BY CHARLES A. DAFFRON

A look within a 38-inch king snake the day after it had swallowed a 40-inch corn snake. The engulfing process took five hours, and the same day the king snake ate an 8-inch De Kay's snake and a 15-inch "glass" snake.

PHOTOGRAPH BY ANTHONY CASTRO

An external view of the king snake with the corn snake within. Note the usual diameter of the king immediately behind the head and the distention of the rest of the body. The multiple smooth protrusions along the king's body represent curves in the body of the swallowed corn snake.



PHOTOGRAPH BY ANTHONY CASTRO

The garter snake in this picture is not dead but is sufficiently subdued to permit the king snake to swallow it. It is being rapidly engulfed despite the fact that the garter snake has inflated its body as much as possible in an unsuccessful attempt not to be a meal.

snake, *Lampropeltis getulus getulus*, quickly gives way to almost complete docility in captivity. Few species thrive as well and as contentedly under captive conditions, and among those who keep snakes as pets the king snake is held in high regard.

This king snake of mine readily submitted to gentle handling the morning after his capture. In handling all snakes, the observer must approach the reptile slowly, avoiding quick, jerky movements, taking care not to squeeze it, because all snakes dislike undue pressure on their bodies.

The king snake, a relatively slow-moving serpent, can be handled with impunity except on the rare occasions when, for some unknown reason, it decides to bite. The bite is anything but vigorous, for the snake does not strike, but gently seizes finger or hand between its jaws. The experience is rather unpleasant, as the small teeth are quite sharp. While handling a king snake, one may also see demonstrated the serpent's forceful powers of constriction as it wraps firmly about an arm. If a coil is pulled, the snake squeezes harder, but can be removed by grasping the tail and unwinding the coils.

Caging the king snake is a simple matter. A wooden box with a glass front and a water pan serves well. Unlike many snakes the king snake does not strike at the glass at the approach of a human being and makes no attempt to re-enact the defensive behavior exhibited at the time of its capture.

My king snakes are at present housed in a large cage with several harmless varieties, and for a short period were kept with a group of copperheads. This procedure is without doubt unwise, but I was rather amazed at the results of keeping the species together. At no time did the king snakes attempt to eat or molest the copperheads. The same was true with the king snakes caged with several harmless snakes until they had been together about two months. Then, with a number of smaller snakes to choose, a thirty-seven inch king snake devoured a forty-three inch corn snake. The glutton was so stuffed with corn snake that he could hardly move. That is the only time a king snake has attacked a cell-mate.

The title of *king* given to this remarkable serpent seems to be well-deserved. No other snake of comparable size is any match for it, nor does the king snake seem to fear the weapons of other snakes. The constricting powers of the rat snake group are unsuccessful against the king snake, and the latter is quite immune to the venom of the pit vipers (rattlesnake, copperhead, and water moccasin). Many times I have observed king snakes bitten fiercely by copperheads and pygmy rattlers without ill effects.

I hesitate to make dogmatic comments on the reaction of other snakes to the king snake, for such observations can easily be misinterpreted. I have the impression, however, that copperheads, as well as several harmless species, behave nervously when a king snake is dropped into their cage. At first the other serpents seem to avoid the intruder, but after a while become accustomed to his presence and show no fear. This reaction is not invoked by placing other unfamiliar snakes in the cage. The most striking evidence of a snake thriving successfully in captivity is a hearty appetite. Many snakes are finicky eaters, and some stubbornly refuse to eat at all under captive conditions. The king snake not only accepts frequent meals with great relish, but readily devours a variety of food. My captive specimens have eaten snakes, mice, birds, lizards, frogs, grubworms, and chunks of beef. This does not necessarily represent their diet in a natural state, although I imagine that all these things (with

the exception of the beef, of course) are eaten, depending on their availability.

One of the favorites on the captive king snake's menu is snakes. My specimens have accepted copperheads, pygmy rattlers, garter snakes, De Kay's snakes, hog-nosed snakes, and corn snakes. They seem to have a preference for the smaller, harmless serpents, although whether this is a natural selection is unknown.

Although the king snakes usually leave their cage-mates alone, a new small serpent dropped into the cage will usually fall prey to the snake-eaters. Frequently I feed the king snakes in a small empty aquarium for closer observation and for taking pictures. When one has become accustomed to his new cage, a small snake of another species is introduced into the aquarium with him. Unless the king snake has not eaten for a week or so, and the small serpent remains motionless, the latter may be unmolested for a long time. But as soon as it glides swiftly about the cage, the king snake quickly grasps it in its jaws, and in a fraction of a second winds many coils about its victim. On a small snake the actual process of constriction is not effective, but other devices succeed in killing or subduing it. The king snake, holding the smaller snake in place with a coil, works its jaws around to grasp the snake's head. Then, the body still held firmly, the king snake pulls violently on the victim's head, spinning its own body round and round, twisting the small snake's neck grotesquely. This method seems to be more effective than suffocating the prey by constriction, but in killing small mammals and birds it is not used. In spite of all this rough treatment the snake may not be killed after twenty or thirty minutes, but is sufficiently subdued. Then, with the head grasped firmly in the king snake's mouth, its smaller prey is quickly swallowed.

Snakes prefer live food, and the king snake is no exception. After they have been in captivity a short while, however, they will readily accept dead animals, or even chunks of meat. One of my king snakes, forty-eight inches long, acts as a garbage can and often exhibits peculiar and amusing behavior. This specimen will accept any dead snake, but only if the prospective meal is made to dance before him. If the dead animal is placed in the cage, he will completely ignore it. If held on a forceps and jiggled in front of him he will invariably grab it. He may grasp the animal for just a moment, then let go and lose interest. If teased with it long enough, however, he will finally seize the animal, throw coils about it, and turn over and over, pulling and twisting his dead prey as if he were enjoying a game. Even after putting on this show, he may release the animal and glide away, but if teased again will go through the same act and eventually swallow it. In capturing live prey this king snake frequently strikes wildly and inaccurately. In fact he is so clumsy in grasping his live victims that I wonder how he ever survived in a natural state. Time after time he will strike at the animal, missing completely, and seize the thing nearest his jaws. Any number of objects have been grasped in this manner — stones, the edge of the water pan, another king snake, his own body, and snakes of other species. On one occasion, in pursuing a large skink, this king snake turned the snake cage into bedlam by repeatedly missing the lizard and clamping his jaws firmly on several copperheads, who, in turn, lost no time in sinking their fangs into him.

This particular specimen is docile and slow moving, but has a voracious appetite. In one day he consumed five race-runners, six inches long, and one glass "snake," ten inches long, handed to him on a forceps in rapid succession. In one week he ate six snakes varying in length from twelve to twenty-four inches. With this prolific intake of food, the captive king snakes have shed their skins regularly every two to three weeks. Whether this represents the frequency of shedding in a natural state, is, of course, uncertain. It seems, however, that with food so readily available in the woods in summertime this observation may also hold true in the wild state.

The king snake has proved to me to be one of the most interesting and entertaining snakes I have studied in captivity. It is indeed a great asset to any herpetological collection, whether it is kept as a pet or for scientific observation. Unfortunately, the behavior of captive snakes does not necessarily represent their habits in a natural state; yet such observations help immeasurably to close the gaps in our knowledge of herpetology.

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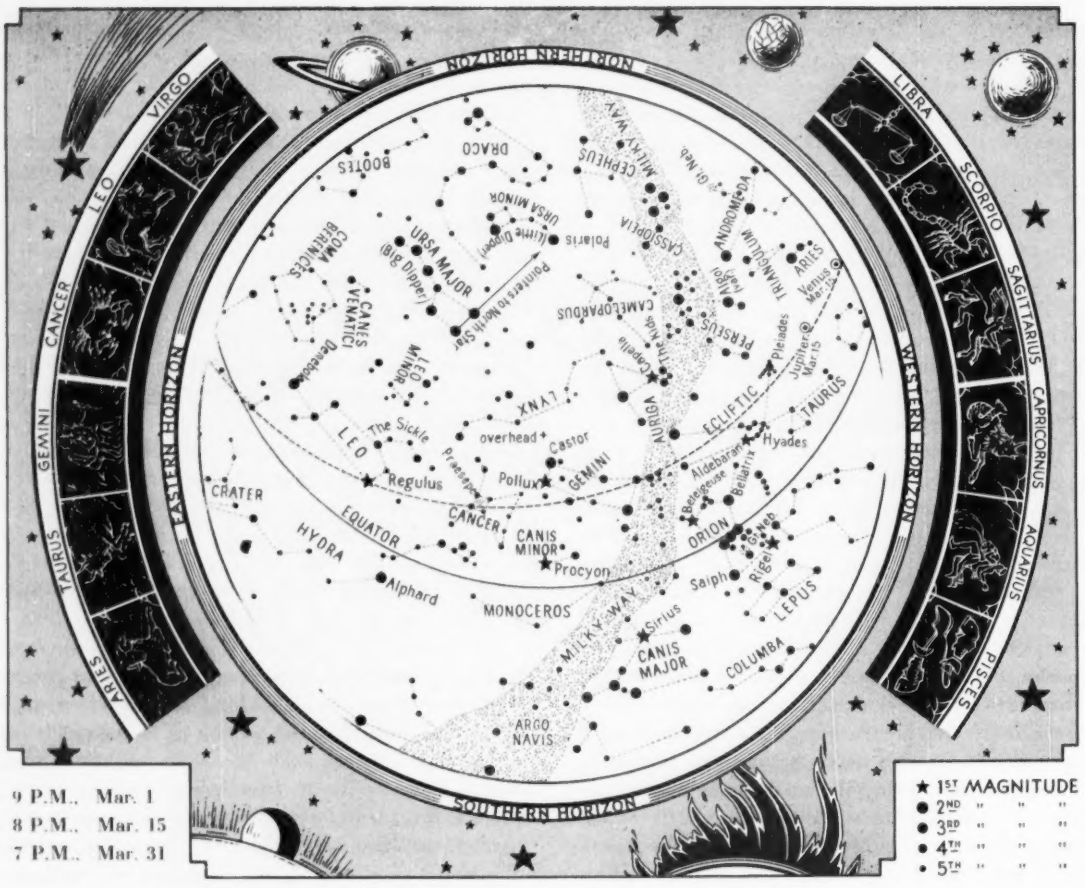
The Centipede

By MAUDE WOODS PLESSINGER

No wonder that the centipede
Can make such record-breaking speed!
It has one-hundred legs or more
To aid propulsion, aft and fore,
And makes a hasty get-away
When apprehensive, night or day,
While I, the animal, must do
My daily stint with only two.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

The Celestial Sphere

By ISABEL M. LEWIS

With the earth as its center, imagine a sphere of infinite radius surrounding us in all directions. This is called the celestial sphere. Although it has no actual existence, this imaginary sphere has a very important role to play in navigation, as well as astronomy, for the location and identification of objects in the heavens. Projected upon this sphere we have the north and south poles of the heavens, the two diametrically opposite points in which the earth's axis of rotation, indefinitely extended, would pierce the celestial sphere. These points are, of course, directly overhead at the north and south poles of the earth. Now imagine the plane of the earth's equator extended indefinitely far in all directions, to meet the celestial sphere in the celestial equator. It passes directly overhead, of course, at all points on the earth's equator. It also divides the heavens into two hemispheres, northern and southern, lying above the corresponding hemispheres upon the surface of the earth.

Above the meridians on the earth's surface, which pass through the north and south poles of the earth and are perpendicular to the earth's equator, lie corresponding meridians of the celestial sphere. These pass respectively through the north and south poles of the celestial sphere, and through the zenith of an observer on the earth, as well as through the nadir, which is the point on the celestial sphere diametrically opposite to the zenith of the observer.

Upon the celestial sphere there are two very important points, the Vernal Equinox, or First Point of Aries, and the Autumnal Equinox. These are the two points, 180 degrees apart, at which the Sun's *apparent* yearly path as seen from the earth projected upon the celestial sphere, cross the celestial equator. This *apparent*

yearly path of the sun is known as the Ecliptic. It is also the *true* path of the earth around the sun seen projected upon the celestial sphere, and it is inclined at an angle of about $23\frac{1}{2}$ degrees to the celestial equator. On either side of the ecliptic, to a distance of about eight degrees, there extends that belt or zone of the celestial sphere known as The Zodiac. Within its limits are to be found not only the Sun and Moon but planets of the solar system — except at times Pluto, whose orbit is inclined as much as 17 degrees to the ecliptic — and the majority of the asteroids. All of these objects have orbits inclined at small angles to the plane of the ecliptic, and so they can never depart far from it in angular distance. Comets, however, may have orbits inclined to the ecliptic at almost any angle and they may be found in almost any part of the heavens, even in polar regions of the celestial sphere.

Constellations are groupings or configurations of stars devised by man according to his fancy, or for his convenience in locating their positions upon the celestial sphere. They appear, to be located at approximately the same distance from the earth, although actually the distances of the various stars in a constellation, one from another and from the earth, differ tremendously. The sun, moon, and planets, moving apparently *among* the constellations and at times in apparent conjunction with various stars, are actually viewed projected against a far distant stellar background.

There are now 88 constellations whose mapped positions cover the entire surface of the celestial sphere. The original 48 constellations described in Ptolemy's great work, the Arabian name of which was *The Almagest*, (about A.D. 150) left some stars ungrouped into constellations, and, in addition, there were great gaps on the celestial sphere lying below the horizon of the Greek astronomers. These were gradually filled in during the centuries of exploration and discovery beginning around the 15th century, until finally the entire surface of the celestial sphere in the southern as well as the northern hemisphere has all of the gaps filled. The irregular and overlapping boundaries of many constellations were straightened out and revisions made by action of the International Astronomical Union in 1928. The boundaries between constellations are now parts of small circles on the celestial sphere, known as declination circles, which lie parallel to the celestial equator; and hour circles, which are the great circles of the celestial sphere that pass through the north and south poles and are perpendicular to the celestial equator. It follows, therefore, that the boundaries between constellations lie always in a east-west or north-south direction. On the whole the boundaries that formerly existed between constellations have not been greatly changed. No brilliant or conspicuous star, or group of stars, has been included in a different configuration by the change, although the huge constellation of Argo Navis of the southern hemisphere was broken down into its various parts. Nearly all new star atlases now define the positions of the constellations by their new boundaries on the celestial sphere.

The system of coordinates that is most widely used for locating the positions of celestial objects for telescopic observation and for giving the positions of sun, moon, planets, stars, etc. in astronomical almanacs and tables and star catalogs, as well as for plotting star positions on maps and in star atlases, is the equatorial system. This gives the position of an object on the celestial sphere by means of its right ascension and declination. The declination of a star on the celestial sphere is analogous to the latitude of a point on the earth's surface. The right ascension is analogous to the longitude of the same point referred to a zero or prime meridian, generally the meridian of Greenwich. Declination, in the same way as latitude on the earth, is distance measured north or south from the equator along a great circle passing through the object and the north and south poles. On the earth these great circles are called meridians of the places through which they pass. On the celestial sphere the great circles, which pass through the north and south poles and are perpendicular to the celestial equator, are called hour circles. When an hour circle passes through the zenith of an observer on the earth it is the celestial meridian of that observer. The right ascension of an object is measured from the zero hour circle of the celestial sphere, which is the one passing through the vernal equinox, the point where the ecliptic crosses the celestial equator, in a direction *eastward* along the celestial equator to the point where the hour circle passing through the object meets the equator. With the declination — distance north or south along the hour circle to the object — this locates the position of the object in the heavens. It tells exactly where an observer should point his telescope to bring the object he desires into the field of view. Right Ascension may be reckoned either in angular measurement up to 360 degrees, which would represent one complete circuit of the heavens in the eastward direction from the vernal equinox; or the same distance may be measured in time, 15 degrees corresponding to one hour of right ascension.

As the earth turns once on its axis in 24 hours, in a west to east direction, the (Continued on page 164)

Weeds along the Brook

By DANIEL SMYTHE

They would be missed, we know,
If no one caught the glint
That shines beneath us high and low
Of pieweed, mullein, mint.

The rising stream may pass
Their roots — but let it come.
The legions of the pink-eyed grass
Stand with the bold tearthumb.

The ferns on every mound,
Mosses and clovers' rank —
These are a few that we have found
Along the living bank.

The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

SOME MORE WATER INSECTS IN SCHOOL

ON ONE school ground or another I have collected representatives of each of the groups of insects discussed in this month's special educational insert. Many of these insects I have caught bumping their heads against windows inside school rooms. Many I have seen on playgrounds under the electric lights. Plenty I have seen in heaps and windrows where they had been blown following their nuptial flight of the night before. I doubt if there is any school, if there is open, fresh water within a mile, where these insects, or some of them, may not be found without moving off the grounds. This holds for cities as well as for the open country.

Time and again I have had teachers and children bring to me the adults of dobson flies. Usually the insects were wrapped carefully in a handkerchief, held captive in a box or bottle or badly smashed by having been stamped on. The enormous clasping jaws of the males command respect from practically everyone, and are not recognized as means for holding the sexes.

The material in the insert should be rich in helping the teacher to understand these insects, or help children and teacher interpret what they see.

Teachers with a collection instinct will want to make collections showing the different stages of the insects studied. This will help the youngsters and others understand which immature stages go with which mature stage. Some of these insects lend themselves well to classroom manipulations. A fruit jar or some other simple aquarium should be all that is really necessary although a good substantial aquarium might be better. Here are a few things to do with such an aquarium.

From the field, if possible, bring in or have the children bring in immature may flies, damsel flies or dragonflies. These are probably the easiest to get and to keep captive. At least this is true of some of them. It would be well to make the collections from pools rather than from streams since it is difficult to reproduce in a fruit jar the running water conditions of a stream. Get these immature stages of as large size as possible with the thought that you may have the opportunity to witness a transformation. Leave a stick or sticks thrust into the jar so that the nymph may crawl out when it comes time to make a change.

We know that many of the most interesting changes take place early in the day. Try then duplicating these conditions by keeping the jar in darkness until school is in session then seeing if bringing it into light stimulates the kind of activity you wish to see. If a teacher can once see and watch with the children the transformation of a single dragonfly I will be satisfied that the effort I have put into my part in this month's Nature Magazine is not wasted.

Children who may have seen a transforming dragonfly may be interested in collecting the shed skins of other dragonflies. Stones, stumps, grasses and sticks near the shore lines frequently are well supplied with these shed skins. See if you can find what kind of dragonfly came from the particular shed case you may have found. See if you can figure from the shed case whether you think the nymph lived on the bottom of the waterway or prowled around among the plants growing there. This should be relatively simple if you will just use your eyes and your reasoning power. Notice the unique lower jaws, the form of which may be seen even in the shed skins.

If you put a collection of nymphs of dragonflies, may flies and damsel flies in an aquarium jar you may find a number of fights taking place soon. Put in a few mosquito wrigglers. Observe carefully what you see. Let me suggest that you put may fly nymphs and mosquito wrigglers in one jar, and dragonfly or damsel fly nymphs and mosquito wrigglers in another, and see what happens to the mosquito wrigglers. Do you find any of them destroyed by the may fly nymphs as was suggested in the book that stimulated me to write this unit of our series. Either the book is wrong, or this unit of our series is wrong. The only proof is what actually happens in Nature. You can run the test in your own school room. This may be a good means of suggesting caution in relying too much on textbooks for your authority. I do not want you to agree with me or with the textbook writer. All I want you to do is come to a conclusion based on what you may see. I am not worrying about the result.

Of course, if you put some dragonfly nymphs in a jar with some mosquito wrigglers you will have a glorious chance to see how these nymphs use that marvelous lower jaw of theirs. It may be better if you starve the nymphs for a day or a few hours before putting them near a prospective meal unless you want to spend some time waiting for results. You may starve some may fly nymphs too if you wish, but I do not recommend that you wait around too long for them to attack and devour a mosquito wriggler. It might prove to be too time-consuming to warrant the effort.

Your aquarium jar will provide you with plenty of opportunity to observe the different means of locomotion represented by the immature stages of our subjects this month. You must see a dragonfly nymph put on its jet-propelled stunt to appreciate it. It can be easily induced by disturbing the nymph with a stick. If the nymph is put in a shallow saucer with some water and ink you may even see the jet stream produced when the stunt occurs.

You will want to observe something of the behavior of gills in some of these animals. Probably the may fly nymphs will bring you the greatest reward here. I have always enjoyed holding some of the common mayfly nymphs in a puddle in the hollow of my hand. I like to notice how rapidly they move their gills, then disturb them to see if their activity stimulates a more rapid breathing action. I do not wish to tell you what you will find, but suggest that you try this either in your own hand or in a jar.

You may appreciate a few hints on collecting material for use in a classroom. I suggest that you get a jar of some sort and an ordinary kitchen strainer. Go to some body of fresh, unpolluted water and sweep the strainer through the water weeds and dump the contents in the jar. If this does not get results go to a stream and hold the strainer down stream from a stone. Turn the stone over and see what you may have caught. The chances are good that in a normal stream you can hardly turn a stone over without finding a may fly nymph of some sort. This will not be true if you are seeking stone fly nymphs or other groups where there is a long nymphal period. One good way for deciding whether a stream flows the year round might be to see what kind of animals are to be found, and then look up whether the life history calls for a long period or a short. You will not find flash streams populated with species that require a long development period. This makes sense, of course.

Another thing you may wish to do is to try to decide if it is safe to predict what all dragonflies or their nymphs will do by what you see one dragonfly nymph or adult do. So much of the "science" offered to elementary and secondary school teachers implies that because one critter does one thing that all of its relatives must do the same. I do not behave like all my relatives, and the same, I am sure, holds in your relationship with your relatives. It may be even more important when we are working with groups representing so many different kinds of animals, as are to be found in the groups here considered, to say nothing of the numbers to be found of any one species. Still there are patterns that can be recognized, and these are worth investigating for your own satisfaction if for no other reason.

Chart-minded teachers may want to make all sorts of charts showing life histories of these insects. Some of these may be based on time and some on place. Where, for example, does this

kind of critter spend this part of its life cycle? How long does it spend in such a period of its life time? Then, too, you may want to show how these insects at different times fit into the general scheme of Nature. What organisms depend on them for food and on what organisms do they depend for food? Most of the answers to these questions are suggested in the chart material. Much of it can be found by the simplest system of all. Keep your eyes open. Try to interpret what you see. Try to come to some conclusion based on your interpretation of your observations. That should provide an excellent ladder on which to build a school science experience.

Camera Trails

By

EDNA HOFFMAN EVANS

IT ALWAYS seems to me that March is the lowest point of the year for Nature photography. Winter still holds sway across the northern part of the country, and by this time the charms of cold weather have begun to pall. Back in November and December there was something thrilling about snowbanks and icicles. Now they are "old stuff," somewhat sooty and shopworn.

In other regions, South or Southwest, there is usually little, if any, snow. But there rain, cloudy skies, chill, and dampness tend to keep the photographer indoors. All in all, March may be the month for the lion and the lamb, but it does not usually offer very much for the outdoor camera enthusiast.

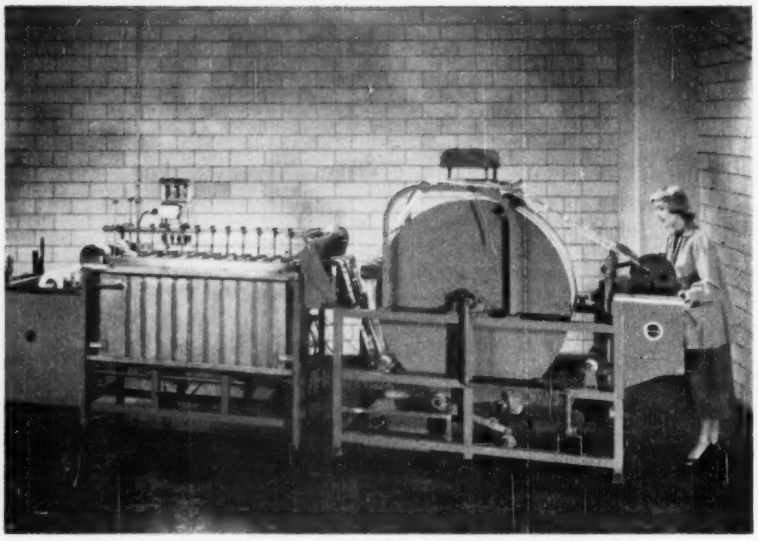
For the reasons I have given above, I usually try to make the March "Camera Trails" section an armchair feature. That way I can survey the photographic scene in fireside comfort. I can overhaul equipment, polish up on "book-learning" techniques, and be all ready for a glorious outdoor jaunt when spring does put in an appearance within the next month or so.

This year, during my armchair reflections, I picked up a series of books and pamphlets on the subject of photography as a career. They are not particularly new books in the sense that they are "hot off the press." I have been accumulating them for some time, but up to now I have not given them much attention.

For the young person who is wondering about photography as a career, the publications are valuable guide posts. For the general photographic hobbyist, they are worthy of note just for the sake of the information they contain, although at first they may make him feel unimportant and small in the general photographic scheme of things. I will have more to say about the hobbyist's importance later.

The publications I have been reading just now include *Careers in Photography*, a small book on vocational opportunities, written by C.B. Neblette and published by Ziff-Davis; "Careers for You and Your Camera," a pamphlet published by Graflex, Inc., of Rochester, N.Y.; and "If You Are Considering Photography," which is pamphlet No. 2 in the vocational guidance series published by the Rochester Institute of Technology.

What struck me first of all as I read the material were the wide range of opportunities open and the vast number of services rendered by photography in modern day living. I have long known photography to be a versatile and an important field, but I had far underestimated the size, number, and importance of its offerings.

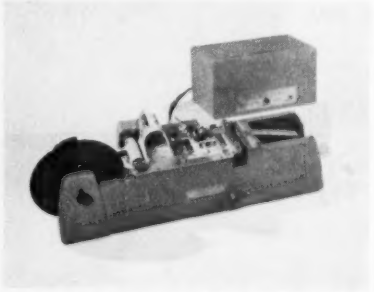


This complicated piece of equipment is designed to serve the hobby photographer for it is capable of drying as many as 2400 snapshots an hour. Actually, two pieces of equipment are joined together — the Kodak roll paper dryer and the Kodak continuous paper processor. Intended for use in photo-finishing plants, the machines are designed for use with continuous roll paper processing equipment.

At almost the same time I was impressed by the fact that photography can be a means of livelihood for so many and yet can be a hobby and a leisure time activity for so many more. I cannot think of any other field where this is true to such an extent. In most activities, we either make our living from them or we use them as a means of recreation. We do not often find thousands of other people using our profession, business, trade, or calling as recreation. In photography, though, this is very definitely the case.

Just what are some of the ways in which people can make a living from photography?

The vocational pamphlet lists no less than twenty-seven different major phases of photography, ranging alphabetically from aerial through X-ray photography. Others include astronomical, commercial, fashion, high speed, illustrative and advertising, industrial, legal, medical, military, motion picture, museum, newspaper news-magazine, photocopying, photofinishing, photographic manufacturing, photomechanical reproduction processes, photomicrography, plan copying, police, portrait, promotional, selling photographic supplies, spectrography, and template photography.



This Kodak album print cutter is designed to speed photo-finishing. Electronically controlled, the machine will cut up to 4000 amateur prints an hour from processed or unprocessed roll paper.

As you can see, some of the fields tend to overlap. Others are definitely narrow and highly specialized. None-the-less, twenty-seven subdivisions of one major field provide a formidable range of possibilities.

The book lists nearly as many fields; the divisions are quite similar. However, in addition to the others, the book also contains a short chapter on natural history photography that will be of special interest to Nature cameramen. Too bad it is not longer and more detailed.

The Graflex pamphlet is aimed more at the working cameraman, with or without professional connections, who wants to sell his pictures. It also includes pointers as to where and how pictures can be marketed, and — more important still — it gives definite information as to how much payment the cameraman can expect.

Photography, as I see it, is not always a line of work that a person prepares for grimly and determinedly. In many cases photographers drift into it; interest leads them but, by and large, some chance chain of circumstances finally opens the door.

There are special schools of photography, to be sure, where a student can learn the latest wrinkles in model posing, trick photography, lighting, and many other phases. Colleges offer a range of courses (I have taken a few of these myself), sometimes even so much as a photography "major" or "minor." High schools, nowadays often have photo-

This is a new Kodak velox rapid printer, designed for the speedy production of 5 x 5 or 5 x 7-inch enlargements from amateur negatives.

graphy classes, or extra-curricular clubs for hobby groups. Churches often have the same, as do YMCA and YWCA organizations in many cities.

Regardless of how they get their initial interest and preliminary training, most professional photographers today pick up the "know how" in school and then serve a period of apprenticeship with someone already established in the field before launching forth on their own.

With all the new advances in photography, the day of the completely self-trained professional photographer is waning. It is waning for the same reason that a beginning lawyer no longer "reads law" by himself before hanging out his shingle, or a prospective doctor merely serves as "assistant" to another doctor before setting forth on a diagnostic and surgical career of his own. There is just too much to learn, too many specialties, and the individual who is actively practicing in the field has neither the time nor the inclination to train a novice from scratch.

With photography, as with many other fields of occupation, the glamor tends to fade with everyday contact. Young people, particularly, want bigger and better surprises every day. Unfortunately, the routine of the job is not very glamorous. In line with that, I was talking not long ago with a young man — a freshman in college. He had taken photography in high school and had found it fascinating. So he had decided to make photography his college major. But, after several months, he was discouraged. He was not learning anything "new." The equipment was quite similar to that which he had used in high school. The glamor had worn off, and he had not found the field to be as absorbing as he had expected.

He is typical of many young people, I think. He wanted something new every day — bigger cameras, bigger enlargers, bigger this, that, and the other. He did not see that his college work in photography was giving greater opportunity for mastery of techniques with which he had become acquainted in high school. He had not yet realized that a darkroom routine is a darkroom routine, and that good pictures often depend on such dull and unglamorous activities as keeping ferrotype plates clean and mixing chemicals properly.

Now for a few random quotations from the material I have been reading for this armchair section. From the Graflex pamphlet: "Photography is not the easiest of professions. . . .There are three main requisites: (1) unquenchable determination, enterprise, and imagination; (2) a thorough knowledge of your camera and how to use it, and (3) fine equipment."

From this career book: "The photographer must be an adaptable person. . . . A person with a one-track mind capable of functioning only in a routine manner, can look forward only to minor positions of a routine nature in photography. . . .A word of caution is in order for those who are affected by asthma, hay fever, and bronchial difficulties generally. On the whole, those whose health make it inadvisable to work indoors and in darkrooms in proximity to chemicals of various kinds, should not take up photography as a career unless they are reasonably certain that they can obtain positions that keep them in the open air. Except in a few branches. . .most photographic work is done indoors under conditions which from the standpoint of health are not too good."

And from the vocational pamphlet: "Practically all fields of photography are open to women as well as to men. Some of the best known photographers are women and the number taking up photography as a career is increasing. Aside from those who have acquired a reputation in fashion, advertising, or news-magazine photography, many others are receptionists, retouchers, photo-finishers, and the like."

So, no matter how you view photography — whether through the ground-glass or view finder of your own hobby camera, or through the lenses of the specialized cameras used for astronomical work, aerial pictures, or X-rays, whether you are thinking of photography as a recreation or as a vocation, it is a big field and getting bigger.

This is true even from the hobbyist's standpoint, and no snapshooter need feel ashamed that he is not "in the business." Snapshooters are big business, too. And, since most Camera Trailsmen (and women) are in the hobbyist class, I think that pictures pertaining to the big business side of hobby photography are most appropriate as illustrations for this section.

Accordingly, take note of the combined Kodak roll paper dryer and the Kodak continous paper processor; intended for use in photofinishing plants, the outfit can dry up to 2400 snapshots

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THE RED TIDE HITS AND RUNS

(Continued from page 128)

pending upon the pigments of these forms, the water may acquire a yellow, green, blue, blue-green or red hue.

Darwin wrote of "great bands of muddy water" far off the coast of Chile during the voyage of the *H.M.S. Beagle* in 1832, and of studying the pale reddish liquid under a microscope, where it was "seen to swarm with minute animalculae darting about and often exploding."

Sicily's lake of blood," however, obtains its bright color from a harmless sulphur bacteria, and the famous rust color of the Red Sea is due, believe it or not, to a blue-green alga, *Trichodesmium erythraeum*, upon which fish apparently thrive, or perhaps are able to ignore.

SUGAR FOR THAT SLIM GIRLISH FIGURE

(Continued from page 136)

If the same sort of computation is made for my visitor we find that its average intake was 1.7 calories per gram of body weight. The daily requirement for a 150-pound man, doing moderately hard physical work, such as house-painting or carpentering, figures out at .05 calories per gram of body weight. Which means that the hummingbird's daily consumption of fuel was at the rate of about thirty-four times the human requirement. And on the best estimate I have found for man at his most intense physical activity, such as the 100-yard dash, his caloric requirement is still less than one-tenth that represented by the sugar intake of the hummer.

Biology Handbook

Foundations of Biology. By Gairdner B. Moment and Helen V. Crouse. New York. 1953. Appleton-Century-Crofts. 282 pages. $2.50.

This is a laboratory handbook in biology and reflects the conviction of the authors that without adequate laboratory experience the student's insight into the science is likely to be on a par with merely reading scientific magazines. They have tried, therefore, to make every laboratory period a memorable experience rather than a chore. The first half of the book is devoted to the well-integrated units and the last half is for record and for laboratory data.

Universe

The Radiant Universe. By George W. Hill. New York. 1953. Philosophical Library. 489 pages. $4.75.

In this discussion of natural phenomena the author views them, and all things in the Universe, as consisting solely of radiation.

A NATURALIST'S TRADITION

(Continued from page 134)

threatens the existence of their shop and business. The vast library of the British Museum across the street has been overflowing for years, and a new and separate library building is proposed on land between the Museum and New Oxford Street. This area includes the Jansons' shop and, in fact, the whole quiet academic quarter that lies along Great Russell, Museum and Coptic Streets. Janson, and other tenants and landholders affected, protested the plan at a recent hearing, but there is little doubt the new library will be approved. In that case, Janson would be forced to accept a government estimate for his shop and the building it occupies (which he owns) and become a tenant until such time as the authorities begin construction. Such construction will probably not begin for a long time in the regime of economy under which Britain is obliged to live. But the Jansons fear it will come eventually, and they will be unable to find another place in London with the necessary storage space (there have only been a handful of business premises built since the war), and worse, that they will lose the momentum of their business, for which there is no compensation, government or other.

Meanwhile, they continue. "I can't seem to get caught up," Janson said, taking off his glasses and squinting at a letter. "It's the Syrian embassy at me again, specimens for their malarial studies." He disappeared into a smaller, darker room through a doorway half hidden by a precarious stack of books.

Dog Training

Train Your Dog with *Kindness*. By Willy Necker. East Lansing, Michigan. 1953. Hall Publishing Co. 86 pages. Illustrated. $1.00.

This little book on dog training comes to us from the Quaker Oats Company, Merchandise Mart Plaza, Chicago 54, Illinois, asking what we think of the book. We like it. It has the right approach to dog training and is a practical little book that will greatly enhance owner-dog relations and make life easier for many a dog. The Quaker Oats people are interested in the book because they are offering it to dog owners who will send thirty-five cents and one Kel-L-Ration label. It is a bargain.

Bird Pictures

Game Birds of North America. Illustrated in color by T. M. Shortt and Luis M. Henderson. Harrisburg, Pa. 1953. The Stackpole Company. $1.00.

Fifty-one upland game birds and waterfowl are pictured in color in this book, which consists of perforated pages with the pictures and brief descriptive text about each bird. The most common and popular species are covered.

HAIR SEALS IN DANGER

(Continued from page 148)

For this reason it had been hoped that some restrictive agreement would be reached at the recent international conference on the harp seal held at the time of the North Atlantic Treaty Conference at Ottawa. However, no restriction was provided, only agreement to conduct research, Canada, Denmark and Norway agreeing to continue joint observations of the situation in general.

Weather Understanding

Understanding the Weather. By T. Morris Longstreth. New York. 1953. The Macmillan Company. 118 pages. Illustrated. $2.50.

First published in 1943 under the title of *Knowing the Weather*, this complete revision of the earlier book indicates that there has been a great advance in weather knowledge during the past decade. In fact, the book dates back to a much earlier volume entitled *Reading the Weather*, which the author wrote in 1914, when weather knowledge was still relatively in its infancy, at least compared to today's information. Being of interest to one and all, weather is a fruitful subject for popular discussion, and it is discussed in this handy little book in interesting and informative fashion.

Linnaeus

Carl Linnaeus. By Knut Hagberg. Translated from the Swedish by Alan Blair. New York. 1953. E. P. Dutton and Co. 264 pages. Illustrated. $4.50.

Here is more than a biography of the great Swedish naturalist and systematist, made forever immortal by his contributions to science and by the L. that appears after so many generic and specific names. Here is a brilliant study of a personality, written for the average reader, who will find as much of interest in Linnaeus' career as philosopher and writer as in his biological eminence.

African Fishing

Heaven Has Claws. By Adrian Conan Doyle. New York. 1953. Random House. 245 pages. Illustrated. $3.50.

This is a fascinating story of adventure and exploration in an area about which little has been written and relatively little known. The author, son of Sir Arthur Conan Doyle, and his wife picked the east coast of Africa and the wild coral islands of the Mafia Channel, among other spots, for a year of search for the unknown. The book is given a sub-title of "Big-Game Fishing off the African Coast," which is a bit misleading since it suggests that the purpose of the adventure was only such sport. While there is a great deal of attention devoted to the sea life of the region, it is only a part of the whole experience. Here is a book that one wishes to read to the finish at one sitting.

On Glacier's Trails

Again this year Frank and Edna Evans are scheduling four wilderness trail trips in Glacier National Park. There will be four ten-day trips — July 6 to 16, July 20 to 30, August 3 to 13, and August 17 to 27. For those who elect to do so, an eleventh day is available for a float trip down the famous North Fork of the Flathead River. Frank Evans is a naturalist and former ranger in Glacier Park, and Edna is a registered nurse. Together they take their groups into the wilderness part of this million-acre wonderland. No equipment is required beyond the actual wearing apparel of the trippers, all packing is done by the staff, and pack animals carry all food and equipment. Glacier Park trails are noted for grades that are kind to the hiker, so just average hiking ability is all that is needed for these trips. Full information may be obtained from H. Frank Evans, 715 W. Garden, Coeur d'Alene, Idaho, up to June 1. After June 1 he is at Panorama Ranch, West Glacier, Montana.

Elliott Goes Fishin'

Gone Fishin! By Charles Elliott. Harrisburg, Pa. 1953. The Stackpole Company. 291 pages. Decorations by Jack Hogg. $5.00.

Charley Elliott is a lover of the outdoors, a conservationist, an eloquent writer — and a fisherman. From his dad he "learned how much more important the fishing was than the fish, and that dead game was only a poor anti-climax to the hunt itself." From his mother he got his "love of all living things, including life itself." Such philosophies, and such interests as have dominated his life, are found in this delightful book by a fisherman, for fisherman, and all who love the outdoors.

Loveridge in Africa

I Drank the Zambesi. By Arthur Loveridge. New York. 1953. Harper and Brothers. 296 pages. Illustrated. $4.00.

Arthur Loveridge of the Museum of Comparative Zoology at Harvard University returned to Africa in 1948 for a safari with a special purpose. He wanted to see the wildlife of Nyasaland before the forests were gone and great ecological change brought about. He found changes, but nine months later he had collected some four thousand specimens and added many new species to the known fauna of the region. This book, however, is no catalog of Nyasaland wildlife. It is a fascinating and often exciting story of this trip at a time of severe drought, which made the muddy water of the Zambesi River acceptable as drinking water. Of course, Mr. Loveridge writes with authority, but he also writes with charm and the enthusiasm of a happy naturalist.

British Insects

British Insects. By George E. Hyde. New York. 1953. The Macmillan Company. 96 pages. Illustrated. $1.35.

This is a popular, introductory account to some of the more common insects of Britain, excluding the butterflies, which are covered in another book in this series.

No Flying Saucers

Flying Saucers. By Donald H. Menzel. Cambridge, Mass. 1953. Harvard University Press. 319 pages. $4.75.

Reports of flying saucers are no new thing. These optical phantoms have been "seen" by many, including the author. They have been reported as far back as Ezekial's wheels in the Bible. They are real, says Dr. Menzel, professor of Astrophysics at Harvard University; just as real as rainbows and just as hard to catch. With the best of humor, and in an entertaining way, the author sets out to explode all of the myths about these apparitions of the airways. At the same time he introduces the reader to many interesting things that take place in the near sky and the far heavens. The Brocken Specter, heavenly ice crystals, mirages, the aurora borealis and many other meteorological phenomena are described and their possible relationship to flying saucer reports become apparent. Here is a fascinating, entertaining and enlightening book.

Conference Postponed

Word comes from Resources for the Future, Inc., that decision has been reached to postpone the Conference on Resources for the Future. No date for it has been set but it may be held in October or November. In the meantime a representative council will be formed the better to perfect plans for the meeting.

Hope Renewed

Easter is a time for reaffirming our faith in the future of mankind. As vibrant spring replaces barren winter, as the joy of resurrection triumphs over the darkness of death, so this should be the time when we help implant hope to replace despair in the hearts of the world's unfortunate.

The $10 food package you send through CARE, 20 Broad Street, New York City, or your local CARE office, can bring renewed courage to suffering war orphans and refugees in South Korea. . .to impoverished villagers in India. . .to Iron Curtain refugees whose dreams of freedom are mocked by their precarious existence in Western Germany. . .to the weary and worried in a score of countries from Italy to the Philippines. Whatever the language men speak, your CARE gift will be universally understood. It will express your Easter prayer for a world united in peace and brotherhood.

THE CELESTIAL SPHERE

(Continued from page 157)

celestial sphere *appears* to revolve around the earth in a equal period in the opposite, or east to west, direction. As the earth is at the same time advancing in its orbit around the sun in a west to east direction the stars will reach the observer's meridian about 4 minutes earlier on each successive night. The result of this rotation of the earth on its axis and advance in its orbit around the sun is the *apparent* rotation of the celestial sphere around the earth every twenty-four hours and the seasonal changes in the appearance of the heavens at the same hour each night.

It is interesting to know, approximately, the right ascension and declination of a few conspicuous objects in the heavens. The declination of an object that passes through our zenith is the same as our latitude. The brilliant Vega passes through the zenith of an observer in latitude about 40 degrees north so its north declination is about 40 degrees. Its right ascension is about 18½ hours. The constellation of Orion is between 5 and 6 hours of Right Ascension, and the star in the Belt of Orion that is farthest north is nearly on the celestial equator. Spica, in Virgo, in the eastern sky on early spring evenings is about 10 degrees south of the celestial equator in declination and nearly 13½ hours in right ascension. The autumnal equinox is, of course, on the celestial equator in right ascension 12 hours. That of the vernal equinox is 0 hours as it is the point of reference, or zero point, in measuring right ascensions.

The right ascensions and declinations of all the brighter stars can usually be read with considerable accuracy from star atlases which show these coordinates. It is convenient, also, to locate upon them the positions of newly discovered comets or other objects with respect to the constellations or the position of a planet at any time when its right ascension and declination are known.

The sun will be at the vernal equinox and spring will begin on March 20, at 5:01 P.M., Eastern Standard Time. The declination of the sun then changes from south to north, or minus to plus, as it crosses the equator coming north. Mercury is at greatest eastern elongation on March 2, and should be easily found in the western sky in the evening twilight. It will be at inferior conjunction with the sun on March 18, then passing to the morning sky. Venus will be at greatest brilliancy on March 7, a magnificent object in the western evening sky. It will be in conjunction with Mars on March 17 when Venus will pass about 7 degrees north of Mars. This should be an interesting phenomenon to observe. Mars is now far from the earth and no brighter than a star of second magnitude. Jupiter is now in Aries and conspicuous in the western evening sky, setting about 10:30 the middle of March. Saturn remains in Virgo, a few degrees northeast of Spica, rising in the eastern evening sky. It is nearly a magnitude brighter than Spica and pale yellowish in color.

CAMERA TRAILS

(Continued from page 160)

an hour. The electronically controlled Kodak album print cutter can trim 4000 amateur prints an hour from processed or unprocessed roll paper. As for enlargements, they can be made on the wholesale scale, too, with the Kodak velox rapid printer.

And so, regardless of those twenty-seven branches of photography, I think the camera hobbyist can be proud of the position he holds in the film and developer world.

Water

Water. By Thomson King. New York, 1953. The Macmillan Company. 238 pages. $3.50.

Despite the fact that water comprises seventy percent of our bodies, we are prone to take it as a matter of course. Yet it has shaped the world, determined the course of nations and is the core of all chemistry, and thus all industry. It nourishes all forms of plant and animal life, and without it Earth would be desert. In his fascinating story of water the author has chosen first to consider it as a substance and its impact upon life through the ages. In the second part of the book consideration is given to what man has done and is doing to water and with water. This is a popular yet inclusive treatment of the subject.

Brothers

Blood-Brothers. By Harry Tegnaeus. New York. 1952. The Philosophical Library. 182 pages. Illustrated. $12.00.

This book brings to the reader an ethno-sociological study of the institutions of blood-brotherhood, with special reference to Africa. It is highly specialized study of the blood-rite, its significance and practice.

Yosemite Mammals

"Mammals of Yosemite" is the title of a special number of Yosemite Nature Notes. Harry C. Parker is the author of this 105-page, illustrated and popular discussion of the mammals, large and small, found in this great California National Park. As with other special issues, this one is of special interest to past and future visitors to Yosemite. The booklet is published by the Yosemite Natural History Association, Yosemite National Park, California, and is available by mail for sixty cents.

New Britton-Brown

Announcement is made by the New York Botanical Garden of the publication of *The New Britton and Brown Flora of the Northeastern United States and Adjacent Canada.* This is the work of Henry A. Gleason, Head Curator retired, and collaborators, and succeeds the *Illustrated Flora* by Nathanial L. Britton and Addison Brown, long a standard work. The new, three-volume work is the only completely illustrated flora for the area covered, which is from the St. Lawrence River to southern Virginia and westward to Missouri and Minnesota. Each of the 4660 species described is fully illustrated by new drawings. The list price of the three volumes is $30, plus fifty cents postage. However, orders placed before July 1, 1953, may enjoy a price of $27.50, postpaid. Copies may be ordered from The New York Botanical Garden, Bronx Park, New York 58, N.Y.

Besley Named

Lowell Besley, professor of forestry and dean of the forestry school at the University of British Columbia, has been named Executive Director-Forester of the American Forestry Association, effective July 1. Mr. Besley, 43, is the son of Fred Besley, former State Forester of Maryland. The new A.F.A. executive was educated at Cornell and Yale and has a broad background of experience in forestry.

Elk Report

"A Biological and Economic Appraisal of the Jackson Hole Elk Herd" is the title of a bulletin by John J. Craighead, published by the New York Zoological Society and the Conservation Foundation, 30 E. 40th St., New York 16, N.Y. In this excellent report Dr. Craighead brings up to date information on the problem of this herd. He covers the history of it and makes management suggestions with respect to it. He also presents the ecological problems occasioned by the relation of these animals to their habitat, winter and summer. The report makes excellent background for an understanding of the still controversial problem occasioned by this herd.

Montana Forests

"Forest Resources of Montana" is one of the series of State forest resources reports that have been published from time to time by the U. S. Forest Service. This report is the work of S. Blair Hutchison and Paul D. Kemp. Copies are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. for fifty-five cents.

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A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

WHICH MICROSCOPE?

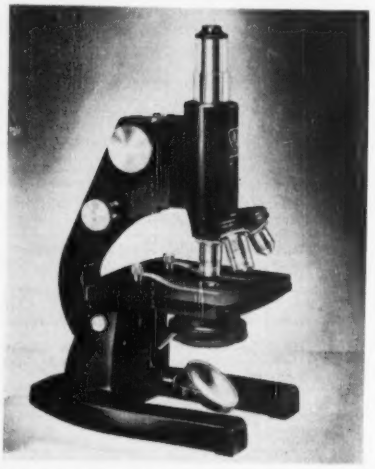
FREQUENT inquiries come to us as to selection of the proper microscope for a given specialty or set of requirements. We have often run articles on specific instruments and their uses, or on individual manufacturers and their products, but until now have not written a symposium, as requested by Miss R. Dorothea Jones, of Elizabeth, New Jersey. At her suggestion, then, we shall attempt to give an answer to the question, "Which microscope?"

Choice of the most suitable instrument is not a simple proposition; there are a number of factors involved. In our opinion, the most important of these is *purpose*. What do you wish your microscope to do for you? Are you a hobbyist interested in anything and everything that can be placed beneath a lens? Is your field entomology; or botany? Does industrial microscopy attract you, or are you preparing for a career as a medical technologist? How about scientific crime detection or the minute inspection of postage stamps in philately? If you wish to become an outstanding research scientist in the field of chromosomes or metallography your requirements will be different from those of the student of experimental embryology. There are nearly as many kinds of microscopes as there are major fields of investigation, and it should, even this early in our discussion, become obvious that no microscope can serve all masters.

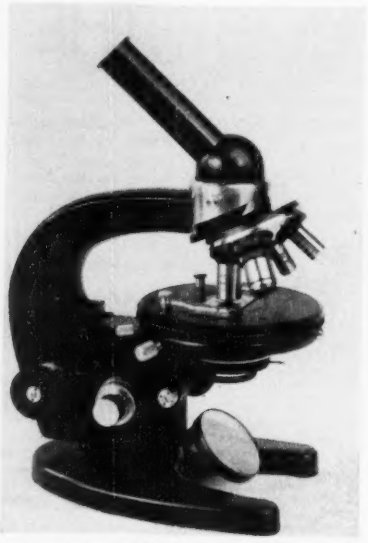
A second and inevitable factor is *price*, especially as affecting the individual purchaser. Decide first the kind of microscope you should have, then price will determine the quality of equipment within the group. It may be that the price will prove so high that you will be unable to buy the type preferred; in such a case a compromise may have to be accepted and the next best item secured. Or, if you have, say, one hundred dollars, and the kind of instrument you wish costs two hundred, you have three choices: abandon the project altogether, buy a cheaper kind, or wait until you have saved two hundred dollars. Each person will have to judge for himself the proper decision to make.

Purpose and price carry with them the factor of amount of *magnification* desired, or "power" of the instrument under consideration. Different sizes of objects require different scales of enlargement, of course, this being the reason why nearly all outfits have means of varying the degree of magnification. But our chief reason for introducing power as a separate factor is that the uninitiated are apt to overemphasize power as a criterion in buying. We are reminded of the little rich boy who ran his finger down the price columns of a catalog and ordered the most expensive microscope listed, since this should of course be the best, then wondered why he could not see a flea as well as through the fifteen dollar miniature scope of his playmate. An irate letter to the manufacturer eventually led to a visit from a representative of the company, who patiently explained to the boy's father the whys and wherefores of a research microscope equipped with apochromatic objectives, inclined binocular body with compensating eyepieces, N.A. 1.40 condenser, and with darkfield and polarizing elements. It was decided that small boys are not very conversant, as a rule, with sines, exit pupils, and corrections of chromatic aberration. Such a fine instrument is of service only in the hands of a person whose training in microscopy equips him to use it properly, and it is indeed true that the fifteen-dollar item is better for viewing a flea. Moral: Do not buy price; by which we mean, do not think that the costliest is necessarily the best. What is "best" for one may not be at all suitable for another. "Best" depends on purpose, and all money spent beyond that level is *empty cost*.

1. Miniature Microscope, Testa S-2, with double-divisible objective. $33.50.



2. Biological Microscope, American (Spencer) 75 H, with three objectives and condenser. $244.00.



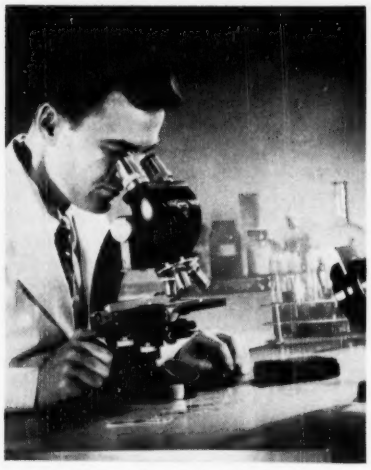
3. Biological Microscope, Zeiss LgC, with inclined, rotating, interchangeable monocular tube and low-position adjustments. Quadruple nosepiece, with two objectives, $325.50.

In cases where neither power nor price are compelling reasons, what should be the basis for estimating the performance of a microscope? The answer is *resolution*, a factor not generally known to those untrained in affairs microscopical, and its expression is *numerical aperture*. Without going into technical aspects of this property here, it can be said that resolution or resolving power measures the ability of a lens to distinguish two fine and close objects as two rather than as a single fuzzy one; to see detail clearly. It is possible to grind a ten-cent piece of glass into a strongly convex and small sphere and thereby obtain high magnification, but with so much distortion that the image is worthless. Correcting lenses for the many kinds of aberrations is a costly procedure, and a good, clear, flat image, free from color halos, and with sharp definition of fine detail is a modern triumph of optical science. The higher the magnification, the more intricate and expensive are the necessary corrections; this is the reason for the high price of an oil-immersion objective. The usual form of corrected objective is termed *achromatic*; the finest, for special uses only, are *apochromatic*. Magnification without resolution is known as *empty magnification*, and is all the name implies. Magnification is expressed as linear dimensions; 10X means that the length of an object appears ten times as long as without magnification. The breadth will also be increased ten times. But to say that such a lens gives 100X, which is areal magnification, is false and misleading. Beware the extravagant claims of a cheap instru-

ment said to "magnify 2000 times" or to have a "power of 2000;" it can not be done. The limit of useful magnification for visual use with a light microscope (as opposed to an electron microscope) is approximately 1000X.

"But," you reply, "I don't know how to form an opinion in this matter. How am I to buy a microscope intelligently when I have no means of judging resolution?"

The answer is the same as in buying any fine article — a watch, an automobile.

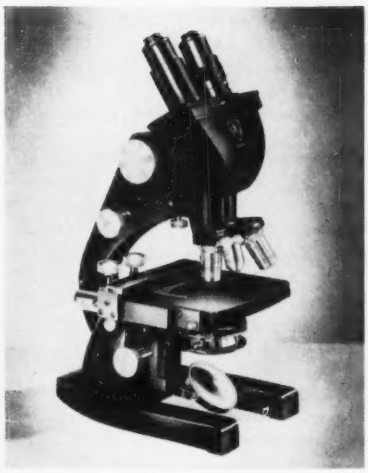


4. Pathologist's or Research Microscope. Bausch & Lomb Dynoptic Labroscope TBV-8, with inclined binocular body, low-position fine adjustment, and mechanical stage. $529.00.

Buy *reputation.* The average consumer cannot take a new sedan apart and minutely inspect all portions of the motor, transmission, and electric wiring. He puts up his money in the faith that the design, materials, and labor on his new car are as advertised, based on the established reputation of the manufacturer, who is jealous of maintaining a good name. The buyer expects performance to justify cost, and knows better than to expect a Cadillac for the price of a jallopy. Buying a microscope is no different. If the microscope selected is made by any of the several internationally known firms, the buyer need have no fear as to quality; he will get what he pays for, unconditionally guaranteed.

Japanese microscopes are as fine-looking snd appear to be as well made as any. It is perhaps too soon to estimate their durability, but some difficulties in repairs or replacements might occur. Because of the labor wage differential they can, of course, be imported for a much smaller figure than the retail price of domestic or German instruments, even with a high tariff, and so they have found a certain proportion of American buyers willing to take a chance on them. Our own trials with them indicate that the optics are satisfactory for all routine work, but somewhat inferior for studies requiring highly-corrected objectives.

Second-hand instruments enjoy a steady



5. Pathologist's or Research Microscope. American 15 MLH. Inclined binocular body and mechanical stage. $476.00.

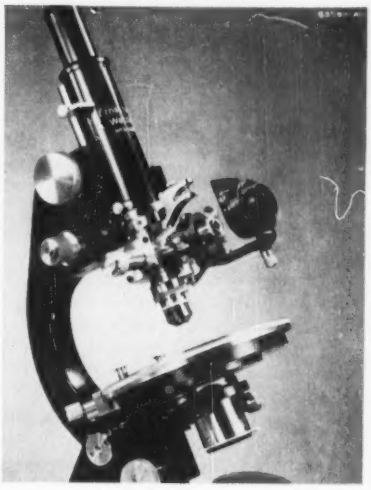
sale. These, when repaired and reconditioned by a reputable firm or factory-trained man, are exactly in the same situation as the used automobile, and the buyer is likewise in the same boat. Do not buy one of these except from the firm that overhauls them, or unless you have sufficient knowledge and experience to appraise the instrument, or can have this done for you by someone who knows how to evaluate a microscope. There is nothing about a microscope that should wear out *if the instrument has been properly handled.* The finish may become tarnished or the model obsolete and the microscope still remain first class. Some chips off the convertable's paint job and a faded top do not interfere with its utility as a conveyance.

For microscopes in the price range under one hundred dollars, see the discussion in this Department for August-September, 1948, "The New Microscopes," in which four makes were analyzed in detail. Some

6. Widefield Binocular Microscope. Bausch & Lomb Stereomicroscope JK-2, with two sets paired objectives and one set eyepieces. Magnifications, 10X and 20X. $224.00.

other new firms have entered the market since, but we have not had the opportunity of inspecting their products. In general, you will get what you pay for, but do not expect the impossible; the manufacturers are not in business for their health.

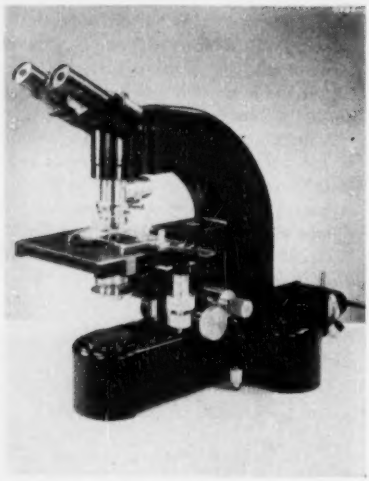
A final factor to consider is the *amount of use* the microscope will receive. To state two rather absurd extremes, it would ordinarily not be a sound economic procedure to tie up several hundred dollars in an instrument that is to be used for only a few minutes once each month, or would



7. Petrographic Microscope, Leitz III M, with polarizing vertical as well as substage illumination and attached condenser. $837.00.

it be wise to expect an inexpensive miniature model to stand up under the abuse given a microscope by class after class of students. A question the buyer should answer: is the microscope a luxury or a necessity?

If a miniature will provide the things you want in a microscope, then there is no special point in buying a standard laboratory model, costing considerably more. An apt comparison here is with typewriters — portable or standard-sized? They will both turn out good-looking correspondence. Is the microscope to be used in a profession or a hobby? By "miniature" we do not mean a toy. The term "substandard" would be convenient to use for size, save that its implications are wrong. Many miniatures are "substandard" in size and lower in price, but are good microscopes for general use and well worth the figure asked. If the objectives are stated to be achromatic, then the microscope is definitely not in the toy class. If not so stated, you can safely rely on the fact that they are *not* achromatic (excuse the double negative, please), as otherwise the manufacturer would definitely say so, this being a strong selling point. Do not purchase any instrument whose lenses are not achromatic except for use as a toy, or for a passing, trifling hobby. The serious hobbyist will want something better.



8. Research Microscope, Leitz Ortholux, with built-in illumination. An example of the finest achievement in optics. $1665.00.

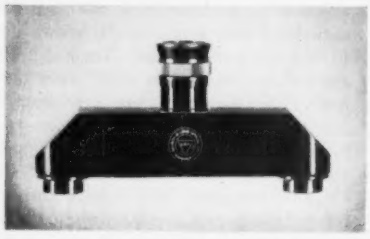
Turning to full-sized instruments, the first to consider is a monocular, monobjective model, without substage condenser, and with plain stage, double nosepiece with two objectives, 10X and 43X, and single ocular, 7.5X, the simplest outfit for average use. For very little more two eyepieces may be secured, magnifying 5X and 10X, in place of the single 7.5X; this will increase the range of available magnifications considerably. This is the standard laboratory or biological microscope for general purpose studies. It may be used for objects as large as a flea or hydra and as small as blood corpuscles; it is suitable for histology and general botany and zoology and for work with sectioned industrial materials.

The magnifying power of the objective, considered alone, is the *initial magnification* of the microscope. Multiplying this figure by the stated power of the eyepiece gives the *final magnification*; the ocular remagnifies the image from the objective. Thus a 10X ocular used with a 10X objective gives an image magnified 100X.

The next jump takes us to the medical microscope, equipped with substage condenser, mechanical stage, and triple nosepiece, adding a third objective, the 97X oil immersion. An instrument of this quality is required by medical colleges, as it permits more exact work with elements of the blood than is possible with the preceding instrument, and is furthermore suitable for bacteriology. Because of the general interest in this subject and in hematology (blood study) it will be well here to state that no lesser microscope should be considered for serious work with either of these fields. Expensive; yes. But so is an airplane, and you can not fly with a Mack truck, in spite of the effectiveness of that vehicle in its proper sphere. When outfitted with an inclined binocular body, the medical microscope provides its fortunate purchaser with as fine an instrument as needed for all save a few advanced requirements in research and photomicrography. It may be employed with polarized light, darkfield, phase-contrast, and other special optical methods.

Beyond this level we could mention several more elaborate types, but these would be purchased only by experts. Research stands of many kinds are available, with optics to order according to the customer's needs. The finest have built-in light sources for every kind of illumination and are particularly adapted for the very finest work in photomicrography.

For general purposes and for many uses in biology, the widefield binocular is scarcely second in importance to those instruments already mentioned. This is a binocular, binobjective type — actually two separate microscopes, one for each eye, placed side by side and operated as a single machine. As can readily be understood, its cost is also comparable to that of two microscopes! These instruments are low-powered and give stereoscopic images. Not until one passes the novice stage in biology is it appreciated that often the problem in using a microscope is to secure *low* enough magnification, rather than high enough. Commonly the range of widefield binoculars



9. Comparison Eyepiece, Bausch & Lomb, for use with two similar microscopes. $135.00.

is from 10X to 40X and they are unsurpassed for viewing all relatively large objects. For example, insects and other small animals, the size of a flea and up; making scale counts on small fishes and snakes; observing small skulls and jaws with teeth, as those of shrews and mice; surveying serial sections of 72-hour chicks and 10 mm pigs and sections of entire organs, as brain and spinal cord, liver and kidney; studying fingerprints, industrial residues, coins and paper money, questioned documents in hand or typewriting, and many other specimens in scientific crime detection; leaves, stem sections, and small flowers, fruits, and seeds in botany; engravings, stamps, gems, minerals, rocks, and fossils, and on through an endless list of specimens that are too large or opaque for the regulation monocular microscope and yet too small for detailed study without some magnification. If a biologist was forced to choose only one instrument, this would be the selection of most.

Quite different is the polarizing microscope, various styles of which are known also as a chemical or a petrographic (geologist's) microscope. The stand is monocular-monobjective, the stage circular and rotatable, and there are numerous accessories for the use of polarized light, such as various prisms, plates, and means of measuring angles. This microscope is necessary for serious work in geology and crystallography and allied industrial fields.

The comparison microscope is the reverse of the widefield binocular, for it is a monocular-binobjective instrument. Two fields of view are scanned together. A hairline divides the eyepiece into right and left halves, the image seen in the left half coming from a lefthand microscope, that in the right half from a righthand microscope. The same results are obtained more readily and at less expense if the consumer owns two microscopes of identical types, as is true in schools and colleges, by securing a comparison eyepiece, which is then used with two regular biological or medical microscopes. This device is employed for matching samples, identifying unknowns by comparison with knowns, and notably in scientific crime detection for comparing bullet scratches, firing-pin marks, fingerprints, handwriting, and the like.

We have by no means exhausted the list. There are special outfits, called metallographs, for the photographic capture of enlarged images of etched and polished metal specimens. There are projection microscopes, called also microprojectors, centrifuge microscopes, and slit ultramicroscopes, as well as the celebrated electron instruments. But our purpose here has been to indicate to the prospective purchaser some of the problems involved in selecting a microscope suited to his needs, rather than cataloging all possible types.

Where and how to buy? When you have decided (1) that you want to buy a microscope, and (2) what kind of instrument will best serve your purposes, you can write to one or more of the manufacturers and request price lists and literature on such microscopes. You may also consult catalogs (sent only to institutions) in the following offices — head of departments of biology, zoology, botany, and bacteriology in schools and colleges, and purchasing office of such institutions; hospital purchasing offices; medical supply companies, and often the larger opticians. Look in the telephone directory, if you live in a large city, to see whether or not there is an agency or representative of the manufacturers in your town. Prices fluctuate a great deal lately, so check to see if the figure in a catlog is still current. We have indicated 1953 prices in the captions of our several illustrations, primarily to give some idea of relative costs, and cannot guarantee how long these figures will be valid. If there are points we have not covered, we shall be glad to supply additional information through correspondence.

He Went Out to Meet Them

WITH FLARES AND WHISTLES and blaring bugles, the Reds had been attacking fanatically all night. Wave after wave they came, in overwhelming numbers.

By dawn, Jerry Crump could see that his position alone was keeping them from overrunning L Company. Twice he went out to meet them with his bayonet. Once he retook a captured machine gun. And four times he left shelter to bring in wounded comrades.

Now, an enemy soldier crept close unobserved. He lobbed a grenade. It landed squarely among the wounded men. Without a second's hesitation, Corporal Crump threw himself upon it, smothered the explosion with his own body, and saved his four companions' lives.

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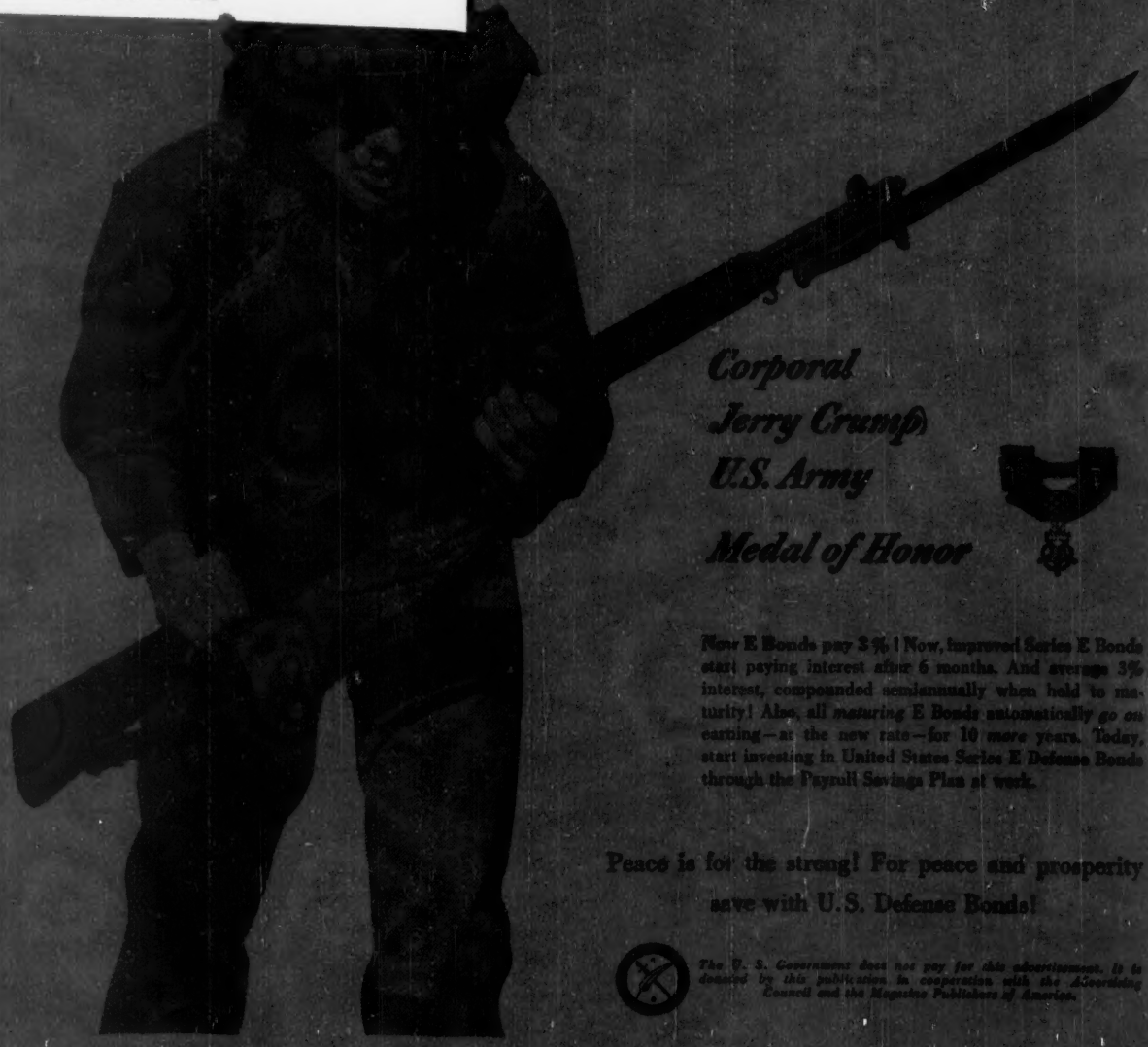

Corporal Jerry Crump
U.S. Army
Medal of Honor

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